The FOUNDRY

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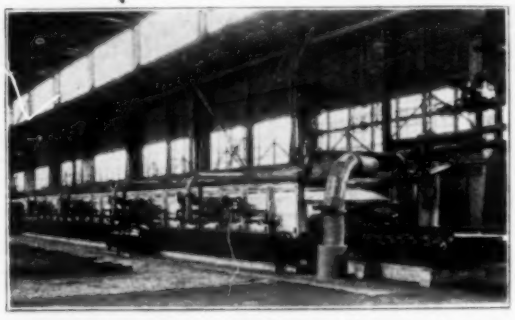
Castings Aid in Changing Structure of Metal

EXACTING engineering requirements of today have necessitated a large increase in the application of heat treating processes. Extensive research, which has been undertaken by various groups, has resulted in a much better understanding of the phenomena produced by such processes. The vast amount of information collected has been utilized in the design of heat treating equipment. Rapid development has been made in recent years in



A Normalizing Furnace of this Type Does the Work of Six of the Older Type Units

automatic and semiautomatic machines. Much progress has been made in the use of electric current for heat treating purposes and in the application of recuperators and other fuel saving devices for gas and oil fired furnaces. Exceedingly important improvements in temperature control equipment also has had a marked effect upon enlarging the field of heat treating. The past few years have witnessed a remarkable growth in the amount of materials which are heat treated. Not so long ago, only a small percentage of the steel castings produced were heat treated, while now, the bulk of the tonnage produced in the country undergoes some kind of heat treatment. While the foundry has benefited greatly by the progress which has been made in heat treating processes, it also has been a contributing factor in the development of equipment which will meet modern demands. Castings are used in the construction of practically all types of furnaces.

Find Where Castings Can Be Sold.

CONTENTS

FEATURE ARTICLES

	Page
Who Should Train Apprentices?—By C. J. Freund	2
Should Foundrymen Subscribe to a Business Code?	6
Marks Century in Producing Malleable Iron—By Herbert R. Simonds	8
Improves Cast Gray Iron with Steel Scrap Additions—By Edward E. Marbaker	10
A. F. A. Plans for Chicago Convention	13
Explains Manganese Steel Production in the Electric Furnace—By J. Trantin Jr.	15
Iron and Steel Industry Needs Unity of Effort—By G. H. Charls	20
Good Ventilating Aids Production—By G. S. Hamilton	22
Find Brass Foundry Costs	25
Melting Iron in the Cupola—Part IX—By J. E. Hurst	29
Bill Tells of Cupola Fettling Doors—By Pat Dwyer	33
Use Sweeps on Tapered Pulley—By J. H. Eastham	36
Government Gives Malleable Data	38

REGULAR DEPARTMENTS

Metals and Melting	24	**Comings and Goings of Foundrymen**	42
How and Why in Brass Founding — By Charles Vickers	28	**Foundry Association Directory**	43
What Others Are Thinking	39	**What The Foundries Are Doing**	45
The Shakeout	40	**New Trade Publications**	46
Trade Trends in Tabloid	41		

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Who Should Apprentices?

"—the apprentice idea will work"

JUST three years ago in May of this year, at the close of a long, strenuous day, the superintendent of a well known electric steel foundry walked into his little office. A few of the older men, who take quite seriously the business of washing up, still were straggling out of the shop. The two furnaces were roaring and sputtering away on late heats. Two or three members of the night gang already had arrived and were arguing something or other quite noisily where they sat on a long bench at one side of the big door. The superintendent after filling and lighting his pipe sat down at his desk to see what had come in during the day. He had been out on the floor since morning. He was a foundryman of the finest type, slightly beyond middle age, an excellent mechanic, fair and sympathetic in handling his men. He liked the foundry and was contented with his job, an ideal superintendent if ever there was one.

He had just tilted his chair back against the wall and was thinking about the next day's work when the works manager burst into the room and established himself precariously on the front edge of a chair on the other side of the desk. Pushing his hat back from his forehead and planting his elbows on the desk he began to talk about the identical thing of which the superintendent was thinking. The works manager, slightly younger than the superintendent, energetic and aggressive, was a great student of management problems. He introduced so many new methods and schemes when he first became works manager, many of the men thought him crazy. However, as most of these innovations worked out well in practice, the men's amused attitude soon changed to respect.

Problem Turns Up

"What are we going to do about those pump frames for Acme?" the works manager asked the superintendent. "The first lot is to be delivered early next week and the pattern is not even laid out."

"I was just thinking about that job, myself," answered the superintendent, "but I don't know what to do. I haven't anyone to put on it. Henry is off, sick and he is no longer young. I hate to crowd him. Herman Bender is the only other man in the shop who can make that job and I can't take him off the housings because nobody else can make them. I rather expect Henry back tomorrow morning. He telephoned yesterday he was feeling much better. If he does not come in I shall have to put Jack on the pump frames and either watch his floor myself or divide it up between the foremen on either side of him.

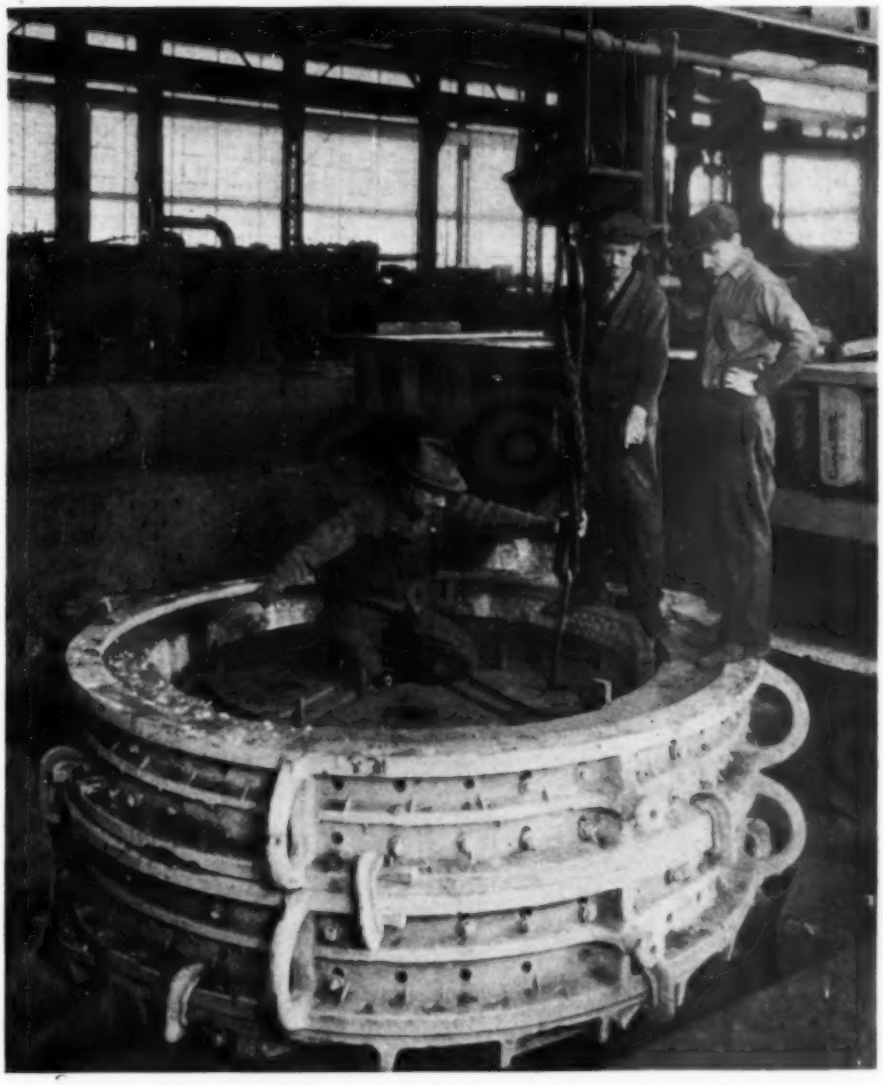
"It is too bad that we have to depend on two of three men for every job that is not kindergarten work. I don't like the plan of putting foremen on molding work. We need them badly enough for supervision.

"I went down to the employment office again yesterday. Blake did nothing but shrug his shoulders. He says that there are no good molders anywhere and he is suspicious of any chap who says he is a good molder because no good molder is out looking for work. For a while I suspected that he told us that story to clear himself, but one day late in winter I took a day off—perhaps you remember. I spent the day on my own hook, looking for molders where we always found them before we had an employment department. I did not find any molders and found only a few of the places."

"Padlocked," smiled the works manager. The

Train

By C. J. Freund



"—foreman should be willing to train apprentices"

superintendent nodded. "Since then I believe what Blake says about not being able to get foundrymen. I think he tries hard but all the trying in the world does little good when there are no molders." For a moment the two men sat in silence. "I have been thinking about this situation during the past year," said the works manager, "and the more I think about it, the more I am convinced the only way out of the difficulty is to get some young fellows into the shop and teach them our business. We might as well face the music. If molders don't come here and if we can't find them, we shall have to make them. While we are at it we might as well do it right and put in a regular apprentice training program."

"I expected you to come along with that plan one of these days."

"You did? Why?"

"Well, you have installed an employment department, laboratory, cost system, sand control and most of the other modern wrinkles. I didn't think that you could resist the apprenticeship temptation much longer."

The works manager laughed. "All those things have worked out, haven't they?" he challenged.

"Yes, they have."

"Well, the apprentice idea will work, too. What do you think about it?"

"I don't know whether it will or not."

"Why not?"

The superintendent shrugged his shoulders.

"I am afraid the foremen will not like it," he said.

"Well," the manager admitted, "I suppose they won't. We hardly can blame them. Foremen are not appreciated enough. They get little praise and too much blame. What objections have they to the training of apprentices?"

"They haven't expressed themselves definitely," the superintendent explained, "but all have expected you would put apprentices into the shop before long and from what I have been able to gather from their discussions, they are afraid apprentices will add to the cost of our work. They say they are hounded enough now about the cost of jobs without having a crowd of kids in the shop who will be practically nonproductive."

"I wish," said the manager testily, "those fellows would get the correct information before they talk. Do you think one foundry after another would establish an apprenticeship system if it added much to the cost of work? How could they compete under present-day conditions? I have studied the question and have been in touch with nearly every foundry operator training apprentices and they tell me that apprenticeship is not a financial burden after the first year. Experience of people I have seen proves that the apprentices soon can compete with journeymen on ordinary work. It should not take them long to compete successfully with the kind of workmen

who nowadays call themselves molders. Certainly, high costs of work at present can be attributed largely to the lack of skill and that is exactly what apprenticeship is designed to overcome."

"Besides that," the superintendent resumed, "most of them simply don't want to be bothered with boys in the shop. They say there will be too much monkeyshining, cooling of hot cores in the water tank and all that sort of thing. Also, they are afraid they will be crowded out. They say that apprentices in the shop will mean

"—production more than took care of itself"

smart young fellows coming along to take their jobs and a new generation of workmen who will not want the old bosses. They are of the opinion that foremen do not count for much in a shop when apprenticeship is established.

"They are all wrong. The foreman is the most vital factor in an apprentice training program. The fundamental feature of apprenticeship is teaching the trade. Imparting molding and coremaking skill. Everything else is secondary. The trade must be taught by the foreman because he understands it best. In fact, in the modern shop only the foreman knows enough about the trade to teach it. Well trained apprentices represent good teaching on the part of the foreman and the credit belongs mostly to him. On the other hand, if the teaching is poorly done the blame also belongs to him.

"I have little respect for the foreman who will permit an apprentice to crowd him to the wall. If the apprentice can overcome the advantage which the foreman has in his years of experience, it is high time for that foreman to get out. The only way the apprentice can overcome the foreman's advantage of experience is by evening school work on the theoretical side of the foundry business. Against this, the foreman easily can hold his own by doing a little studying. Most foundry foremen I know do not study much and can stand a lot of it.

"I can't help thinking that they have other objections, perhaps more serious ones, but as I said before I have not talked with any of them and I don't know what these objections are."

"Well," the manager said, "let us try to find out all about the foremen's attitude. We shall have to answer all their arguments. They are entitled to our consideration because, if for no other reason, the success of an apprentice training program will depend primarily upon them. I consider it unfair to begin such an undertaking before each foreman can see his way clear."

With his hand on the door knob he continued. "In any case, this much is certain, apprenticeship will be established in this shop." The door closed after him.

Within a week the superintendent visited his old friend Jenkins, superintendent of a competitive foundry in which apprentices had been trained for many years. After they had spent 20 or 30 minutes exchanging the news, a silence fell for a moment or two.

"Well?" questioned Jenkins.

He knew that the superintendent had come on some definite errand because after the manner of many old friends they had not been together for several years.

"We are thinking" the superintendent confided, "about putting on some apprentices."

"It's about time," Jenkins commented.

"We have done a lot of thinking about it and the longer we think the more we feel that there is much more to it than appears on the surface."

Jenkins nodded and smiled knowingly.

"For instance," the superintendent continued, "what about the foremen? What is their real objection to apprenticeship? I know that our foremen have certain arguments against the system but I am afraid they have others I know nothing about. Can you tell me the fundamental objection of foremen in general in this matter? We have determined not to take on any boys until all our foremen are fully convinced and set to go."

"In our experience," Jenkins replied, "foremen brought up a great many arguments against the system, but we soon realized that back of them all was one fundamental factor although some of the foremen themselves did not understand it, could not express it and therefore made other and simpler objections. When this fundamental difficulty was overcome, the others quickly vanished in thin air."

"That's what we need to know," said the superintendent, "the big fundamental objection from which the others come."

"Well, I think I shall put it like this: In a certain way, foundry foremen have not had a fair chance in past years and apprenticeship only makes the problem a little bit harder. You remember a time when the foreman was more of an instructor than anything else and the biggest part of his job was to show his men how to do their work and to correct them when they made mistakes. Times have changed and today it is production, production and more production. We constantly are hounding the foremen to get out the work and in spite of crowding and planning he never can do quite as much as his boss would like. Nevertheless, the foreman still is responsible for the instruction of his men, at least in theory, and when something goes wrong with a job we demand an explanation from the foreman why the man was not shown how to do the work prop-

erly. When I take 5 minutes off to sit down and think the matter over, I can't see where the foreman under ordinary conditions can get time to do any instructing. You know as well as I that the ordinary superintendent becomes impatient with a foreman who spends too much of his time explaining. That is getting to be considered a waste of time. The foreman is expected to concentrate on planning his work and rushing it out. This is what I consider the foreman's fundamental objection to apprenticeship, although as a rule he does not realize it. He is responsible for the instruction of his men, but gets no time to instruct them and he feels that the training of apprentices is out of the question when he can't train his men."

"The foreman should be willing to train apprentices at present to make his work easier in the future."

Production Increased

"How can you expect the foreman to devote any thought to the future, when his everyday problems keep him busy from early morning until late at night and make him so tired that he can't do any thinking in his own time? The average foreman has had little encouragement to do any long distance thinking."

"I guess that is correct," admitted the superintendent, "but how did you get around the problem in your shop?"

"The obvious solution simply was to get our foremen back gradually from the habit of flying off the handle, to the habit of instructing and explaining and of correcting and encouraging when things were done wrong."

"What happened to production? It may be nice for the foreman to spend his time explaining, but you have to get out the tonnage and after your foremen became teachers, who did the pushing?"

"You'd be surprised," replied Jenkins, "the production more than took care of itself. When the foremen began to show and instruct, the men became so much more efficient that little of the old crowding or hounding was necessary. In fact, the reduction in scrap established new weekly production records on some jobs without trying for them."

"What happened when the apprentices came into the shop?"

"Nothing happened. The foremen by that time were so used to instructing that they took to teaching apprentices without making a peep."

The superintendent next day reported back to his works manager and told him he thought he had the key to the foremen's attitude on apprenticeship. He repeated his conversation with Jenkins. The works manager said that the story sounded good to him. They should use Jenkins' plan in preparing their foremen for apprenticeship in the shop.

They proceeded quietly, tactfully and skilfully and achieved noteworthy results. They encouraged the foremen inclined to discuss work problems with this or that worker and almost imperceptibly curbed the outbreaks of the blustering type. Gradually the workmen began asking each other what had caused such a great improvement in the place. Working conditions became more pleasant. The men were more regular in attendance. Arguments and misunderstandings disappeared almost entirely and the product of the shop improved perceptibly in quality.

At this juncture the works manager decided he was ready to begin his apprentice training work in dead earnest.

The superintendent, one morning on his way to the works manager's office to tell him once more the old old story about the need for a new sand mill, saw a young man leaving the office and going down the street. He was not known to the superintendent and did not appear to be a customer or salesman or anyone else of a class that might be expected to call upon a works manager.

Set Up an Organization

"Who was the visitor?" he inquired.

"He is an applicant for the job of apprentice director. I am looking for a man of that kind."

"Apprentice director? What for? We haven't any apprentices yet."

"Certainly not, but we need a director before we put on the first apprentice."

"Isn't that a little unusual?"

"Probably," the manager admitted, "but I am convinced that the usual way of beginning apprentice work is the cause of most of the failures. A few boys are hired and the engagement of a director or supervisor is postponed until more boys are in the organization. In the meantime the boys are neglected and forced to shift for themselves. The natural result is that they quit and the enterprise is given up as impractical.

"Strange that people who exercise good judgment in other affairs do not see this clearly. We shall proceed logically. We shall get a director and set up an organization. We shall have our shop well prepared before the first boys come in and when they do come in we shall have a man who is a member of our organization to take care of them."

"Fine work. The director can take over a big part of the shop instruction and lighten the foremen's teaching job."

"Nothing doing," said the manager. "The foremen and shop instructors if we ever have any, will teach the apprentices as far as shop and trade skill are concerned. We want to teach our boys the foundry trade and it should be taught by those who know it best. The foremen in our shop know the trade best and they are the ones who should train the apprentices.

"I am not even looking for a first rate foundryman to fill this director's position. I have interviewed a number of people and the man you just saw looks best. He is an engineer by profession and has completed an apprentice training course. He has had some foundry experience and is interested in personnel problems. The foremen know much more about the foundry than he does and he knows it. His job will be to organize the work. He will draw up schedules of work and pay. He will hire and fire apprentices and will care for them individually. He will be responsible for their morale and discipline. In addition, he will arrange with the school authorities for the apprentices' instruction in theory and will maintain the many outside contacts necessary for the success of the undertaking.

"You and the foremen will decide what the boys need to be taught and what kind of work they will do. He will arrange your ideas into formal programs. I want no high-handed official for the job. He will have no actual authority, but will serve in an advisory and administrative capacity. He will assist you and the foremen in the job of trade instruction but the job is yours."

"When will he begin work?"

"The first of next month."

"When will we hire the first apprentices?"

"In three or four months, I suppose."

"Three or four months? Wow! Did you say months?"

"Yes, three or four months," said the works manager. "We shall require about that time to organize and get ready."

This is the first instalment of an interesting article by C. J. Freund on the installation of an apprenticeship system. The second and concluding part will appear in an early issue.

The Marshall Supply Co., operating in Pittsburg, Kans., and Tulsa, Okla., has been appointed agent for the Botfield Refractories Co., Philadelphia.

Should Foundrymen Subscribe to a Business Code?

SINCE the publication of an editorial in THE FOUNDRY Nov. 15, outlining briefly the purposes and accomplishments of trade practice conferences called for various industries by the federal trade commission, many interesting opinions have been elicited from leaders in the foundry industry. The editorial recited the role of the commission, its work in calling conferences where competitors in the same line of business compile and ratify certain rules which when adopted become a code of practice governing the relations of each with the others. Certain of these rules governing quality of product, acceptance of blanket orders without specifications and selling goods below costs all adopted by other industries seemed to be applicable to conditions encountered in the foundry industry.

Accordingly, two questions were advanced by this editorial. The first inquired if a federal trade commission conference on trade practices would be beneficial to the entire foundry industry. The second question raised the point of whether the Malleable Iron Research institute, the Steel Founders' Society of America and the Gray Iron institute, representing three important branches, should seek to interest the commission in calling a conference of the entire industry.

The opinions expressed in answer to these two questions vary, as might be expected. Many who contributed their opinions already were familiar with the work of the federal trade commission through the public print or through acquaintance with other industries which have participated in such conferences. In some cases comments were accompanied by the request that the writers be permitted to remain anonymous. This request will be observed. The opinions which follow do not necessarily reflect the judgment of the editors of THE FOUNDRY, but are presented in the interest of clarifying thought.

One foundryman, who desires his name withheld says:

> Why should the foundry industry seek to interest the government in its problems, particularly by attracting the attention of a department charged with regulating the means of conducting our business? It seems to me that the less government in business, the better for business.

A paragraph in the publication of the federal trade commission outlining the purposes and accomplishments of trade practice conferences expresses the commission's comment on this point. The paragraph follows:

> The procedure is predicated on the theory that the primary interest of the federal trade commission is the interest of the public. The public is entitled to the benefits which flow from competition and each competitor is entitled to fair competition. The legitimate interests of business are in perfect harmony with the true interest of the public. That which injures one undoubtedly injures the other, and the commission, in the creation of the trade practice conference procedure, provides a medium through which, in appropriate situations, the interests of both may be mutually protected in matters of competitive practices. It also offers, in the conferences, a common ground upon which competitors can meet, lay aside personal charges, jealousies and misunderstandings, freely discuss practices of an unfair or harmful nature, or otherwise not in the public interest, reach a basis for mutual understanding and confidence, and provide for the abandonment of such practices (into which they often drift unwillingly and without wrongful intent), to the mutual advantage of all, and to the protection of the public.

Such procedure is familiar to foundries that have had experience in trade association work. The determination of principles which govern fair competition and the condemnation of unfair practices is common in association work, but here a violation of established rules can at the worst result only in a forfeiture of association privileges on the part of the offending company. Any manufacturer who subscribes to trade practices accepted under jurisdiction of the federal trade commission and afterwards violates those principles, it is said, may be cited by the commission and on refusal to cease and desist may encounter fines based upon the injury which the infringement entails. This police power of the commission has been upheld in certain classes of complaint, but even members of the commission do not agree as to whether it applies to all rules.

Confusion seems to exist as to the meaning of trade practices determined under the federal trade commission and trade customs such as have been adopted by various foundry groups. This confusion doubtless is due to the similarity of the terms, for a clear line of demarcation may be drawn between the two code types.

For example, the uniform trade customs, adopted and circulated by the Ohio State Foundrymen's association, now known as the Ohio Foundries association, which was one of the first to propose such a code contains 17

rules or statements of principle. Of these, six refer to type, quality, marking or ownership of patterns. Five cover points on selling or quotations and one each is devoted to damages for defective castings, claims for error and the customary limitation imposed upon delivery by fire, flood, strikes or accidents beyond control of the manufacturer.

It will be observed that each of the points covered, many of which are subscribed to by the American Foundrymen's association, the Foundry Equipment Manufacturers association, the Malleable Iron Research institute, the Steel Founders' Society of America and the National Association of Purchasing Agents, deals with a definite point in the relations between the seller and buyer of castings. A committee of the American Foundrymen's association now is working on the problem of uniform trade customs.

Make Rules

By contrast, the various rules laid down at trade practice conferences, held in co-operation with the federal trade commission, have covered an entirely different field. A few of these, selected from a series of conferences will serve to illustrate the difference. The use of inferior materials, misbranding, imitation of trade mark, defamation of a competitor, patent suits or threats of suits based upon misrepresentation, free delivery or discrimination through freight rebates, inducement of breach of contract, enticement of competitor's employes, gifts or bonuses to buyers, misuses of terms of quality, such as "plate" glass, "Sheffield" silverware, and price discrimination through accepting contracts for split shipments at a price for a large quantity and finally discrimination through selling goods below cost, all are deprecated. Those subscribing to the various rules disclaim such practices.

It will be observed that the rules invariably refer to matters arising between competing manufacturers. They promise competition upon a higher plane of business honesty, but they do not mention any points in the customer-manufacturer relationship previously outlined in the codes of trade customs.

J. H. Redhead, president, Lake City Malleable Co., Cleveland, in discussing the editorial in the THE FOUNDRY says, in part:

> There is probably not a sicker industry in the country today than the foundry business and as you are covering the field, it seems to me most appropriate that you should take a position of leadership in promoting vigorously any campaign which promises to better the conditions. Most of the foundry problems are due to faults right in the industry itself, but which can never correct themselves except through the assistance of some outside agency, such as the federal trade commission.

An executive in the steel castings industry favors the conference idea, but emphasizes the necessity of inducing wide interest and a full attendance at such a conference. He says, in part:

> Only those producers who agree to the trade practices are bound by them, and unless a large percentage of the industry subscribe to them, the results of a trade practice conference are of no value. The federal trade commission at present cannot institute a charge of unfair competition against any producer that violates the fair trade practices listed at such a conference and that has not agreed to abide by such a list.

This view is correct and a further point has been raised by a leading trade association executive. He says that in event of a violation of any rule, the offending manufacturer at present may evade discipline by announcing his withdrawal and the renunciation of the principles to which he previously subscribed. This weakness in the enforcement angle is under consideration and doubtless will be remedied.

Studies Conference Problems

A. J. Tuscany, manager, Gray Iron institute, Cleveland, states that the institute has studied the matter of a conference of the gray iron branch of the industry. In fact, a representative of the department of commerce recently addressed the board of the institute, on invitation, outlining what has been accomplished in other industries. He says:

> A committee of our membership was authorized, which committee will carefully study the entire subject and make a report as to the advisability of a trade practice conference in our industry. I believe the malleable and steel casting associations should do likewise. Later, if it is deemed desirable, a joint meeting can be arranged of the committees from the various branches of the industry. All of this activity again brings forcibly to our attention that the outstanding difficulty, or it might be termed the outstanding bad practice in the foundry industry, is the lack of a one price policy. As to whether trade practice conferences provide the best means to bring about the establishment of a one price policy in the foundry industry, I am not prepared to say.

This brings to attention the problem of rules which might be proposed in a conference of the foundry industry as a whole, or any of its great divisions previously mentioned. Such practices as are general in nature, covering adherence to quality, elimination of freight rebates, split shipments, inducement of breach of contract, etc., might serve to limit certain abuses that may be common to all branches of the industry. However, when the question of standard prices, uniform costs, avoidance of selling below costs and similar problems are presented, widely varying views and opinions will be encountered.

Consider certain classes of malleable castings for the automotive industry as an example. A rear axle housing for one automobile manufacturer differs not only in weight but in many details of design from one required by another car bulider. This will require different procedure in molding, casting and coremaking on the two jobs in question. Obviously, the costs will differ and a uniform published price whether on the piece or on the pound basis will be found impossible of attainment.

Needs Careful Consideration

A steel casting executive expresses the need for careful consideration of the points which might be raised in a trade practice conference. He says:

> It is my opinion that the foundry industry needs to make a careful analysis of what actually transpires during the period between the broadcasting of the inquiries for prices and the final placing of orders. Having a complete list of most of the movements and actions in this period, a list of fair, ethical and businesslike practices can be prescribed in detail. Likewise, a list of the unfair and uneconomic practices can be made. This analysis will cover only that phase of competition resulting from inquiries. It can be extended to the solicitation of new customers and it should probably cover every phase of competitive practices. Even though the industry should have a trade practice conference under the auspices of the federal trade commission, I think it will be necessary first to make the above study to obtain the facts and prepare the recommendation to be submitted to such a conference.

Might not such a study of the entire field of castings manufacture and sale be valuable to the industry? While a few differences may be noted in details, in practically every case an inquiry is issued. Competing foundries obtain blueprints, make estimates based upon the blueprint, or in some cases upon the pattern equipment and then submit prices. Too often, these steps are only preliminary to many negotiations whereby the buyer seeks special concessions in service, delivery and price. Also, the submission of a price too often is taken by the foundry merely as a starting point for refiguring, shaving

(*Concluded on Page* 19)

MARKS CENTURY *in* Producing Malleable Iron

By Herbert R. Simonds

LOCATED near the town of Easton, Mass., about 30 miles south of Boston, a small but business-like malleable iron foundry plugs away year after year, apparently indifferent to what other malleable iron foundries and encroaching industries may be doing, have done, or are contemplating.

In this foundry difficult castings are turned out as regular part of the day's work. They excite neither comment nor question. The place has the established and permanent atmosphere which it deserves, for it has been producing malleable iron castings continuously for 100 years. The Belcher Malleable Iron Co., Easton, Mass., still in operation, claims the distinction of the longest period of continuous operation of any malleable iron foundry in the United States.

H. A. Schwartz, reviewing the development of the malleable iron casting industry in his well known work, *American Malleable Cast Iron*, states that Seth Boyden succeeded in producing malleable iron castings at his plant in Newark, N. J., in 1826, which apparently was the first malleable iron foundry in this country.

Seth Boyden had several brothers who engaged in the foundry business and who became familiar with malleable practice soon after it was developed by their ingenious and inventive brother. One brother, Alexander, went to Easton, Mass., to work for Frederick Fuller, who at that time was operating a small gray iron foundry on the site at present occupied by the plant of the Belcher Malleable Iron Co. Alexander Boyden is known to have been prominent in this foundry for several years, and it seems probable that under his direction the foundry started the production of malleable iron castings. Later the business came into the hands of Daniel Belcher and has been operated continuously under the Belcher name from that time to the present.

A large volume devoted to the history of Easton, Mass., now in the Brocton, Mass., public library, states that an iron furnace was built in Easton in December, 1751, and that it has been in operation ever since. The history, written toward the end of the nineteenth century, continues:

"This furnace is the oldest industry now carried on in Easton, with the exception of the grist mill business at the Green. The furnace did good service in the Revolutionary war, turning out small cannon and cannon balls. Not far from the village is a depression between two hills near the Sharon

Back To 1830

MALLEABLE iron castings have been made by the Belcher Malleable Iron Co., and its predecessors on the same site in Easton, Mass., for the past 100 years. Alexander Boyden, brother of Seth Boyden who originated the process a few years earlier in Newark, N. J., probably made malleable iron castings in the Easton plant as early as 1830. The Newark plant was razed in 1914 and that leaves the plant at Easton, Mass., the oldest malleable plant in continuous operation in the United States.

FIG. 1—EXTERIOR VIEW ONE OF THE OLDEST MALLEABLE IRON FOUNDRIES IN THE UNITED STATES WHICH DATES BACK TO THE TIME OF SETH BOYDEN, THE DISCOVERER OF THE MALLEABLIZING PROCESS

road, where these cannon used to be tested and where many of the old shot have been dug out of the bank in later years."

The foundry and the furnace were built on the same property and both were operated by Lincoln Drake. Early records describing the furnace and the foundry are somewhat confusing. According to Schwartz in *American Malleable Cast Iron*, the Easton iron foundry was established in 1752. This probably refers to the same plant described as the Easton furnace in the *History of Easton*. The practice of pouring direct metal from the blast furnace was current at that period and in all probability the metal from the blast furnace was poured either into molds or into the pig bed as occasion demanded.

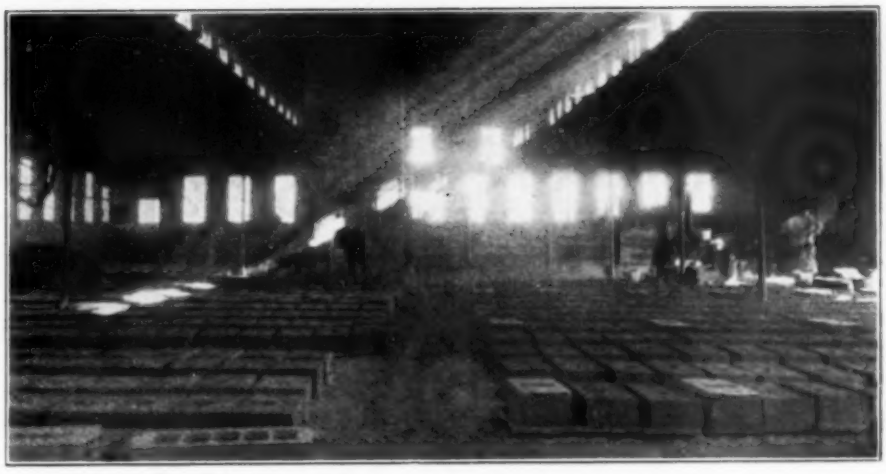


FIG. 4—INTERIOR VIEW OF THE MAIN FLOOR LOOKING TOWARD THE AIR FURNACE

One point brought out in the local history does not appear in Schwartz' historical reference. The name of the foundry was changed soon after Alexander Boyden came connected with it. This indicates the importance attached to his affiliation with the firm and adds a good deal of weight to the theory that he brought the art of making malleable iron to Easton from his brother's foundry in Newark, N. J. The local history states that Daniel Belcher bought the business in 1849 and started making brass and iron castings for the agricultural trade. That he was successful may be inferred from an item: "These things are sent all over the country and the firm enjoys a high reputation for the excellence of its work."

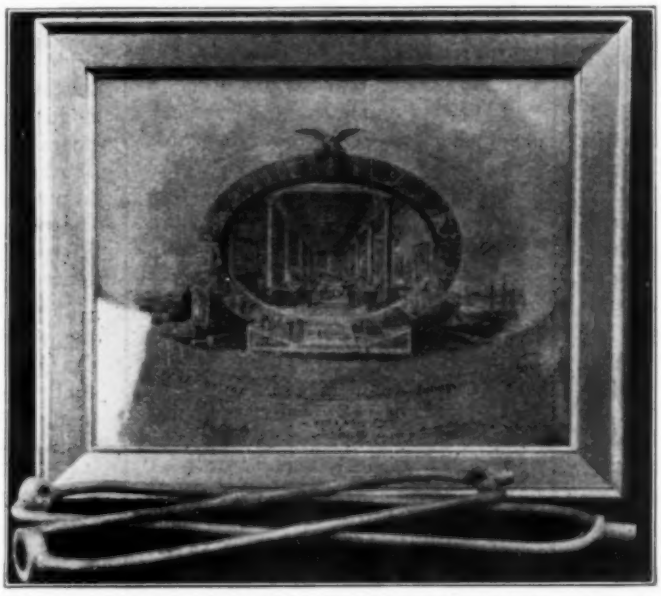


FIG. 3—DIPLOMA AWARDED THE FOUNDRY IN 1847 FOR THE EXCELLENCE OF ITS PRODUCT

In addition to a regular line of jobbing, the foundry at present makes a great number of unusual castings typified by the fire tongs shown in Fig. 2. These tongs present a pretty problem to cast without warping or showing shrinkage defects. Each pair of tongs is a single casting of delicate, tapering outline. The complete length of the casting from tip to tip, that is including both legs, is about 6 feet with varying thickness of section. Two of these fire tongs are cast in a single flask. Metal is poured in a long runner, which distributes the stream through eight small flat gates into each mold, as may be noted in the illustration Fig. 2. One-half of the casting is molded in the drag and half in the cope. The same method is used with the hinged type of tongs. Two sets are molded in a flask, but the arrangement of the legs is slightly different. The hinged ends are separated and the ball tips are brought close together on opposite sides of a single core, as may be noted in the illustration. Fireplace hardware, ornamental gates and fences and many similar items used in and around New England homes, are made in large numbers at this plant of the Belcher Malleable Iron Co. An exterior view of the plant as it appears today is shown in Fig. 1. An interior view of the plant as it appears today is shown in Fig. 4.

Main trophies and historical documents are on display in the office of C. Bateman Swasey, the present head of the foundry. On the diploma shown in Fig. 3 the inscription reads: "The Massachusetts Charitable Mechanic association awards this diploma with a silver medal to Lincoln Drake for excellent specimens of malleable iron castings exhibited by him at the exhibition and fair of 1847."

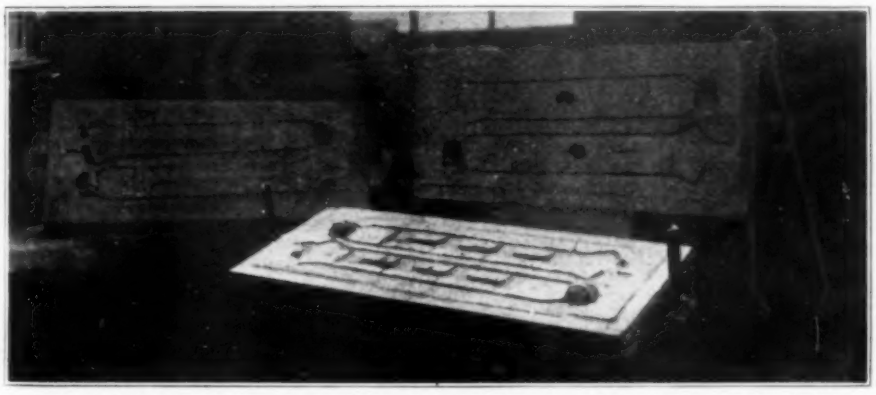


FIG. 2—FOLLOWBOARD, PATTERNS AND MOLDS FOR MALLEABLE IRON TONGS

W. J. Holtmeier has been appointed sales manager, grinding division, Hill-Curtis Co., Kalamazoo, Mich. For the past 12 years Mr. Holtmeier has been associated with the Hisey-Wolf Machine Co., Cincinnati, in various capacities, for the past 3 years as general sales representative and advertising manager.

Improves Cast Gray Iron with Steel Scrap Additions

Jolting Molten Metal in the Ladle Also Found Beneficial Since Gases Are Freed, the Sulphur Is Made Innocuous and the Solution Is Mixed Thoroughly

By Edward E. Marbaker

TWO distinguishing features of the Corsalli process are the increased blast volume and the alloy melting apparatus which is built integral with the cupola. The latter consists of a pipe connecting the melting zone and the stack. The lower part is sealed into the cupola wall, and the charging door is at the level of the charging floor, and is closed by a suitable lid. The calculated addition of alloy material is made through this opening. It is recommended that the pieces be about fist size. A small additional charge of large size charcoal is necessary to maintain the flame which enters the apparatus through a narrow slot at a temperature of over 2900 degrees Fahr. The melting proceeds rapidly and at the conclusion of the charging, a shovelful of sand is thrown into the apparatus to prevent it from becoming contaminated by the high flying slag and coke particles.

When a forehearth is used, the molten alloy material is introduced through a slot into the forehearth and passes through the hot gases, and thence directly into the stream of iron coming from the spout. The slag is held back by a siphon. In this way even higher percentages of iron alloys can be added to the bath.

Thus, the Corsalli apparatus overcomes many of the difficulties attending alloy additions to cupola metal. Usually when such additions are made to the charge in the shaft, in the spout, or in the ladle, fragments of the alloy which have not melted sometimes are found in the iron. Even when the alloy material is added to the metal in a forehearth, there is no absolute certainty of the result, and a cooling effect surely takes place.

Compares Properties

THIS is the third and concluding instalment of the series by the author on the various methods of securing desirable structures in cast iron. In it the author describes some of the features of the Corsalli cupola and the Dechesne process of jolting. Included are tables giving some of the results obtained from tests of cast irons made by the various methods. The first article entitled "Properties of Cast Iron Are Related to Its Structure," appeared in the Dec. 1 issue on page 979, and the second entitled "Many Processes Are Used To Produce High Grade Castings" was published in the Dec. 15 issue on page 1005.

In Table I a series of results obtained by the use of the process are shown. This process can be used effectively in melting alloy cast irons containing vanadium, molybdenum, and and other materials. Fire resistant cast iron containing chromium and high silicon cast iron for the chemical industry now may be produced economically in the cupola. For purposes of comparison, some results obtained from tests of cast irons containing varying amounts of steel, and taken from Geiger's *Handbuch der Eisen und Stahl Giesserei*, ar presented in Table II.

It will be seen from the table that the optimum addition of steel to the charge lies between 25 and 37½ per cent in ordinary cupola melting. By using the Corsalli process, it is claimed that it is possible to add as much as 66 2/3 per cent, thus lowering the carbon content, and increasing the strength values. The iron made by the latter process possesses a brinell hardness of 230-250, but the machinability is said to be satisfactory. Hard spots, commonly encountered in cast irons made from charges containing considerable quantities of steel, do not occur at all.

Dechesne's method of producing high test gray cast iron differs materially from the other processes which have been described according to Irres-

Table I

Analysis and Properties of Corsalli Iron

Test No.	Carbon per cent	Silicon per cent	Manganese per cent	Phosphorus per cent	Sulphur per cent	Modulus of rupture lb. per sq. in.	Deflection inches	Tensile strength lb. per sq. in.
1	2.82	2.07	1.33	0.26	0.111	90,500	0.39	50,500
2	2.71	2.21	1.23	0.24	0.111	84,600	0.36	49,900
3	2.64	2.00	1.40	0.28	0.108	82,500	0.43	48,900
4	2.69	2.35	1.45	0.25	0.120	81,500	0.39	55,000
5	2.79	2.21	1.30	0.26	0.110	81,900	0.36	53,800
6	2.71	2.35	1.30	0.28	0.119	76,700	0.39	50,600
7	2.65	2.44	1.36	0.26	0.100	80,300	0.39	52,500
8	2.81	1.97	1.32	0.24	0.090	92,100	0.40	55,600
Average	2.73	2.20	1.34	0.26	0.109	83,760	0.39	52,100

berger, THE FOUNDRY, 1926. The essential feature of the process is a forehearth which is arranged so that the metal which is drawn from the standard cupola, is subjected to violent jolting. In the other processes, the cast iron is improved by chemical and thermal means. In this case, the operation is entirely mechanical. It has been found possible by violent agitation to free the molten iron from gases, to mix it thoroughly, to deoxidize it, to render the sulphur innocuous, and to bring about more perfect solution of the carbon.

The method was suggested by Dechesne primarily for the purpose of desulphurizing cast iron immediately after tapping from the cupola. In theory it was expected that by agitating the metal, the solid and liquid constituents would be mixed thoroughly, and that the specifically light slag materials would find their way easily to the surface. The action of manganese added for the purposes of combining with sulphur would be more efficient, and the manganese sulphide also would find its way out of the melt. It was found possible to obtain a sulphur reduction up to 55 per cent of the original amount present, and that by maintaining the metal at a high temperature, it could be reduced still further. The question of desulphurization became relatively unimportant when it was found that a much more general improvement in the quality of the iron was obtained by jolting, and that this offset the deleterious effects of even a high sulphur content.

Processes for the improvement of the properties of gray cast iron which have been described earlier in this paper, or in other papers, are based upon superheating to high temperatures, or upon the maintenance of a suitable temperature, either before casting, as in the forehearth, or after casting, as in the Lanz process. According to Piwowarski, all cast iron possesses a particular critical temperature, depending upon its chemical composition.

Iron has an increasing tendency to solidify gray according to the degree

Table II

Properties of Cupola Iron Containing Steel Scrap

Steel addition per cent	Total carbon per cent	Combined carbon per cent	Graphitic carbon per cent	Silicon per cent	Manganese per cent	Phosphorus per cent	Sulphur per cent	Modulus of rupture lb. per sq. in.	Tensile strength lb. per sq. in.
0	3.63	0.51	3.12	1.76	0.53	0.49	0.06	43,800	22,000
0	3.94	0.54	3.40	2.35	0.56	0.52	0.06	39,400	22,100
0	3.81	0.63	3.18	1.96	0.44	0.45	0.10	40,000	21,800
Average	3.79	0.56	3.23	2.03	0.51	0.49	0.07	41,070	21,970
12.5	3.37	0.53	2.94	1.76	0.57	0.52	0.14	49,600	26,800
12.5	3.36	1.06	2.30	2.16	0.20	0.32	0.06	47,900	26,200
Average	3.37	0.80	2.62	1.96	0.39	0.42	0.10	48,750	26,500
25.0	2.95	0.51	2.44	1.83	0.55	0.61	0.10	58,800	36,600
25.0	3.16	0.60	2.56	2.53	0.54	0.49	0.10	52,300	33,200
25.0	3.23	1.08	2.15	2.36	0.24	0.33	0.06	57,500	31,500
Average	3.11	0.73	2.38	2.24	0.44	0.48	0.08	56,200	33,770
37.5	3.40	0.57	2.83	1.97	0.48	0.47	0.09	54,800	32,400
Average	3.40	0.57	2.83	1.97	0.48	0.47	0.09	54,800	32,400

Table III

Analysis and Properties of Dechesne Cast Iron

No.	Total carbon per cent	Silicon per cent	Manganese per cent	Phosphorus per cent	Sulphur per cent	Modulus of rupture lb. per sq. in.	Deflection inches	Tensile lb. per sq. in.	Hardness Brinell	Pouring temperature degrees Fahr.
R 0	3.72	2.22	0.46	0.37	0.17	59,400	0.45	29,100	222	2410
R 10	3.20	2.27	0.56	0.38	0.08	72,400	0.49	37,000	216	2390
R 15	3.40	2.34	0.45	0.33	0.09	74,600	0.49	39,100	228	2370
R 20	3.38	2.15	0.42	0.37	0.13	80,400	0.49	42,600	217	2425
R 20	3.62	1.74	0.71	0.30	0.17	77,500	0.56	43,400	240	2370
R 30	3.48	2.15	0.45	0.20	0.13	79,000	0.55	45,500	215	2480
R 30	3.48	1.57	0.68	0.41	0.14	81,800	0.47	48,200	224	2450
R 50	3.02	1.83	0.40	0.34	0.14	87,400	0.49	47,600	215	2450
R 50	3.88	2.04	0.66	0.15	0.14	92,400	0.71	46,200	189	2460
Average	3.46	2.03	0.53	0.32	0.13	78,320	0.52	42,080	218	2420

Table IV

High Test Gray Iron Made by Different Processes

	Total carbon per cent	Silicon per cent	Mang. per cent	Phos. per cent	Sulphur per cent	Modulus of rupture lb./sq. in.	Deflection in inches	Tensile strength lb./sq. in.	Brinell hardness	Transverse strength lb.
Electric furnace	3.12	2.23	0.64	0.42	0.042	69,900	0.19	.....	.....	4,480
Cupola	3.44	1.68	0.32	0.56	0.106	.....	.....	.....	.....	3,250
Cupola and electric furnace	3.33	2.01	0.54	0.55	0.030	.....	.....	.....	.....	4,287
Wust oil-fired furnace	3.31	2.40	0.76	0.46	0.055	53,800	.....	31,400	195	.....
Wust oil-fired furnace	2.70	1.66	0.90	0.42	0.077	78,500	.....	47,000	215	.....
Corsalli	2.73	2.20	1.34	0.26	0.109	83,760	0.39	52,100	230–250	.....
Steel added to 0.0 per cent	3.79	2.03	0.51	0.49	0.07	41,070	.....	21,970	.....	.....
Cupola charge, 12.5 per cent	3.37	1.96	0.59	0.42	0.10	48,750	.....	26,500	.....	.....
Cupola charge, 25.0 per cent	3.11	2.24	0.44	0.48	0.08	56,200	.....	33,770	.....	.....
Cupola charge, 37.5 per cent	3.40	1.97	0.48	0.47	0.09	54,800	.....	32,400	.....	.....
Dechesne	3.46	2.03	0.53	0.32	0.13	78,320	0.52	42,080	218	.....

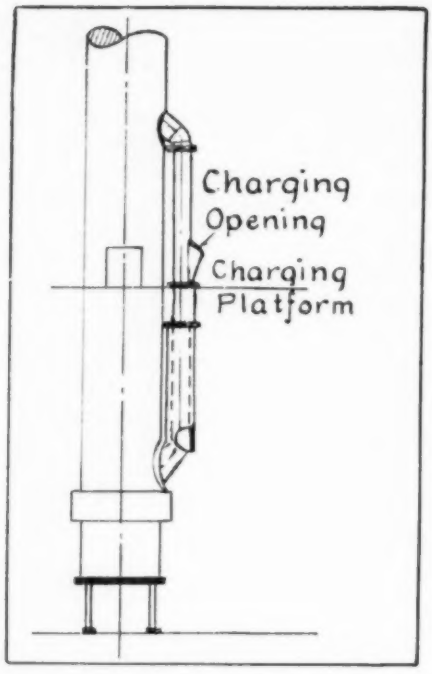


FIG. 1—ALLOY MELTING APPARATUS FOR CORSALLI PROCESS WITHOUT FOREHEARTH

to which this temperature is exceeded in the melting process. This tendency is caused by the solution of the graphite particles, and the decomposition of the iron carbide molecules. Undissolved graphite acts as a nucleus for the formation of coarsely laminated precipitations, which affect the structure detrimentally, and is therefore, to be avoided. The complete solution of the graphite and the decomposition of the carbide should be attained by thorough jolting while maintaining a good casting temperature. This is claimed to be accomplished by the Dechesne process. The ground mass of the iron so produced consists largely of pearlite, and the graphite is divided finely and uniformly distributed. Some cementite and ferrite also are present.

Liberal steel additions can be made to the charge without increasing the viscosity of the molten metal, and without risk of white solidification or piping on cooling. Under all conditions, the jolting of the molten iron brings about material improvement in the technical properties of the metal. It is stated that whether the iron contains 3.2 or 3.6 per cent carbon, 1.6 or 2.6 per cent silicon, the following properties are obtainable with the normal casting temperature of 2450-2550 degrees Fahr.: tensile strength, 42,500-57,000 pounds per square inch; modulus of rupture, 71,000-85,000 pounds per square inch and 0.6-inch deflection with test bars 30 millimeters (1.18 inches), in diameter and distance between supports 600 millimeters (23.6 inches). With 15 millimeter test bars, under the same conditions, bending strengths up to 160,000 pounds per square inch and one inch deflection have been noted. The brinell hardness varies between 180 and 240. These figures were obtained from castings made in both green sand and dry sand molds.

A jolting hearth is in operation at the Industriewerke in Spandau, Germany. It is constructed of cast iron plates, except for the bottom plate which is exposed directly to the jolting. This is made of cast steel. This hearth has a capacity of 5 tons per hour output and when it has been filled with metal, it is subjected to a jolting motion imparted by a rotating cam shaft which passes under the front of the forehearth. The back of the forehearth rests upon a rocker. The cam raises the front of the forehearth 4 centimeters (1.57 inches), and then allows it to drop. A schedule of one hundred shocks per minute has been found to produce the desired results. The power required is supplied by a 5-horsepower motor which operates the cam shaft through a worm gear with a ratio of 36:1.

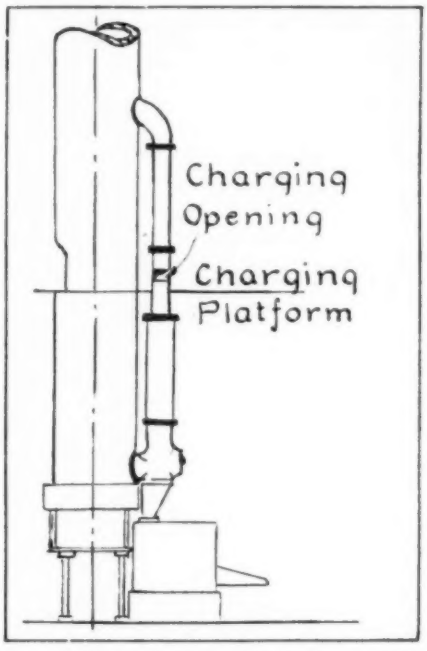


FIG. 2—MELTING APPARATUS FOR ALLOYS IN CORSALLI PROCESS MAY BE ATTACHED TO THE FOREHEARTH

The forehearth is connected with the cupola by a special spout which prevents the entrance of slag. The slag is removed in the usual way. The surface of the bath of molten iron is completely shut off from the blast pressure in the cupola, and remains under atmospheric pressure. This was found to aid in the degasification of the metal.

Before starting the furnace the inlet pipe of the forehearth is closed and a portion of the gas generated by the combustion of the bed coke is admitted through a supply pipe to the forehearth, from which it escapes through the tap hole, or other openings provided for the purpose. When the first iron appears at the spout after the blast has been turned on, the gas supply pipe is closed, the inlet from the spout opened, and the tap hole closed. By this procedure, the forehearth is heated to about 2200 degrees Fahr., and thus the inflowing iron is not cooled appreciably. Immediately after the tap hole is closed, the jolting is started, and continued until the forehearth is full enough to be tapped. Results of a number of heats are shown in Table III. Averages taken from the various tables have been used in the preparation of the summary presented in Table IV so that a comparison of the results may easily be made.

It is to be noted that in the majority of the processes described, the foundry cupola is used for the melting of the iron, although certain modifications are necessary. In the Corsalli process, the auxiliary device for the melting of the ferroalloys constitutes the principal change. The jolting forehearth of the Dechesne process is an accessory which can be added without in any way changing the essential design of the cupola. The Wuest furnace is a special contrivance which has the disadvantage of high cost of construction, although the operating expense appears to be quite low. The electric furnace is well known to be expensive in both construction and operation.

The results show, that since the Corsalli and Dechesne processes are readily adaptable to the equipment which is normally to be found in all foundries, it would seem to be worth while for American foundrymen to try these methods in their effort to improve the quality of their castings.

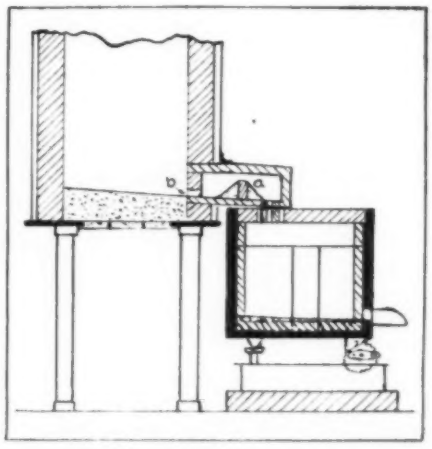
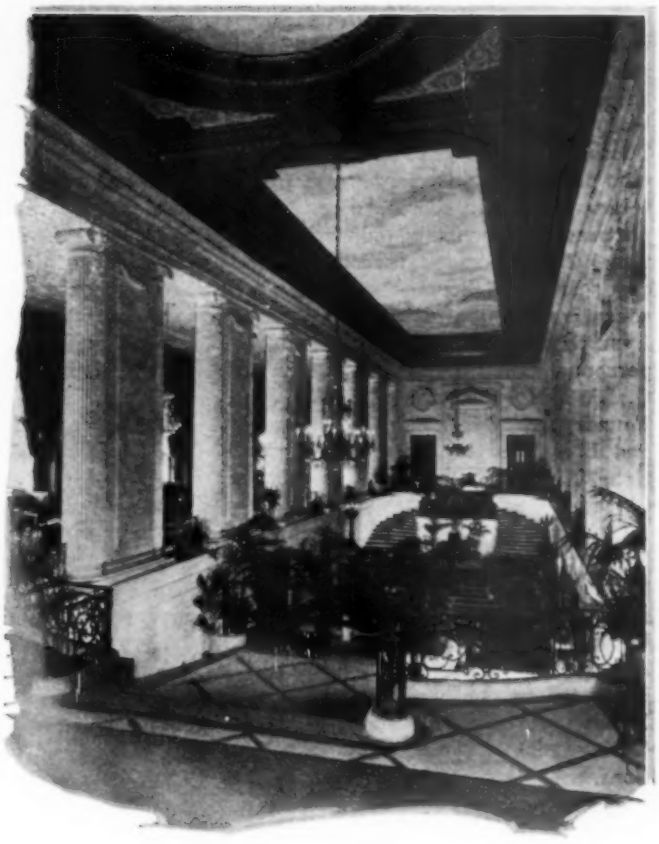


FIG. 3—JOLTING FOREHEARTH USED IN THE DECHESNE PROCESS

A. F. A. Plans for CHICAGO Convention



Grand Staircase Hall in the New Hotel Stevens, Chicago, Where the 1929 Convention and Exhibition of the A.F.A. Will Be Held

PLANS for the 1929 convention and exhibition of the American Foundrymen's association, which will be held in Chicago, April 8 to 11, are being completed rapidly. Preliminary announcements regarding many of the activities for the convention week indicate that the coming meeting will be most interesting and profitable to the foundrymen of America. In numerous ways, the Chicago convention will differ from any gathering of the association in recent years.

One of the important features which marks this convention is the fact that all activities of the week, including registration, technical sessions, luncheons, banquets and exhibits, will be held in one building, the recently completed Hotel Stevens. It is interesting to note that the Stevens is one of the world's largest hotels with 3000 guest rooms, a spacious exhibit hall and many other interesting features. The hotel is located on the famous Michigan boulevard, and overlooks the lake and the important lake front development.

All technical sessions will be held in special rooms on the third floor, with ample accomodations for simultaneous sessions. Registration headquarters and the exhibition of equipment will be held on the basement level, immediately below the main lobby. This compact arrangement permits members and guests to inspect the exhibits and attend the technical sessions without the loss of time and inconvenience usually present when the activities are scattered.

While each exhibitor will not occupy as much space as in Philadelphia and some of the recent exhibitions, the exhibits promise to be as interesting in character as in previous years. Many developments in foundry equipment and supplies have taken place since the meeting in 1928, and undoubtedly manufacturers will feature the new developments in their displays. Doors of the exhibition hall will be thrown open Monday morning, April 8, at 10 a.m.

The program for the convention is as follows:

MONDAY, APRIL 8

10 a.m. Registration
Exhibits Open
2 p.m. Committee Meetings
4 p.m. Cast Iron and Steel Founding Shop Operation Courses

TUESDAY, APRIL 9

10 a.m. Foundry Costs
Steel Founding
Iron Founding
12:30 p.m. Round Table Nonferrous Cost Methods
Round Table—Steel Founding
4 p.m. Sand Control
6 p.m. Dinner gathering of those interested in sand control
7 p.m. Foundry Sands

WEDNESDAY, APRIL 10

10 a.m. Nonferrous Founding
Cast Iron Research
Materials Handling
12:30 p.m. Round Table—Nonferrous Shop Practice
2 p.m. Foreman Training
4 p.m. Cast Iron and Steel Founding Shop Operation Courses

THURSDAY, APRIL 11

10 a.m. Malleable Iron
Apprentice Training
12:30 p.m. Round Table Malleable Founding.
2 p.m. High Test Cast Iron
4 p.m. Cast Iron and Steel Founding Shop Operation Courses

The program of events, as now arranged, is so full that little opportunity is offered for general entertainment for the men. However, arrangements are being made for special entertainment for the ladies attending the convention, and plans of that part of the program will be announced later. Entertainment features for the convention week open with the exhibitors dinner on Monday evening, an annual affair sponsored by the Foundry Equipment Manufacturers association and the American Foundrymen's association. A general session on foundry sands will be held on the third floor of the hotel on Tuesday evening. The meeting will be preceded by a special dinner on the same floor. The annual banquet, the most impressive social event of the convention, will be held on Wednesday evening. The usual provision for plant inspection trips will be made by committees of Chicago Foundrymen.

The shop operation course on cupola practice, which proved to be of such interest and value when tried out at the Philadelphia meeting is to be conducted again. The papers committee has decided to broaden that type of meeting and to conduct courses for both gray iron and steel foundrymen at the Chicago convention. Each course will consist of four meetings where instruction will be given in the fundamentals of shop practice.

Round table discussion meetings where the problems of the shop are talked over informally have proved so successful in the nonferrous and malleable branches of the association that a similar meeting has been arranged for steel foundrymen attending the convention. Those attending these meetings are privileged to ask for discussion on any topic which they may wish to bring before the meeting.

Foreman training, a subject of in-

creasing importance to foundrymen, will be given a place on the program this year. Several men, prominent in the work of training foremen, will lead the discussion at the meeting. Those who have expressed a willingness to serve on that program are as follows: A. B. Pierce, director, department of industrial education, National Metal Trades association, Chicago; M. H Mellen, superintendent of education, General Electric Co., West Lynn, Mass.; A. D. Lynch, director of personnel, Ohio Brass Co., Mansfield, O.; W. F. Coleman, W. A. Jones Foundry & Machine Co., Chicago; and L. A. Hartley, director of education, National Founders association, Chicago.

On Tuesday a technical session will be held in the evening, breaking a precedent of many years. The subject to be considered at that session is sand control. The evening meeting was scheduled so that all of those interested in that important phase of foundry work can attend without conflicting with attendance at other sessions. At four o'clock Tuesday afternoon, immediately preceding the evening session, a sand control meeting will be held at which the fundamentals of sand control will be explained and methods of starting sand control work in the foundries will be outlined.

The various phases of apprentice training work will be discussed at a session on training foundry apprentices. J. A. Davies, general superintendent of the Philadelphia branch, Westinghouse Electric & Mfg. Co., will explain why apprentices should be trained and A. M. Cornell, vice president, Pettibone-Mulliken Co., Chicago, will show how the training program may be carried on.

Awards Prizes for Papers Read at Philadelphia

The board of awards of the American Foundrymen's association has announced the prize winning papers for the 1928 convention at Philadelphia. The papers and authors are as follows:

"Temperature Measurements of Molten Cast Iron," by H. T. Wensel and W. F. Roeser.

"The Effects of Lead on the Properties of a Complex Brass," by O. W. Ellis.

"Reducing New Sand Consumption in a Steel Foundry," by H. A. Mason.

H. T. Wensel is associate physicist and chief of the pyrometry section of the bureau of standards, Washington.

W. F. Roeser is assistant physicist in the pyrometry section of the bureau of standards.

O. W. Ellis is metallurgical engineer in the research department of the Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

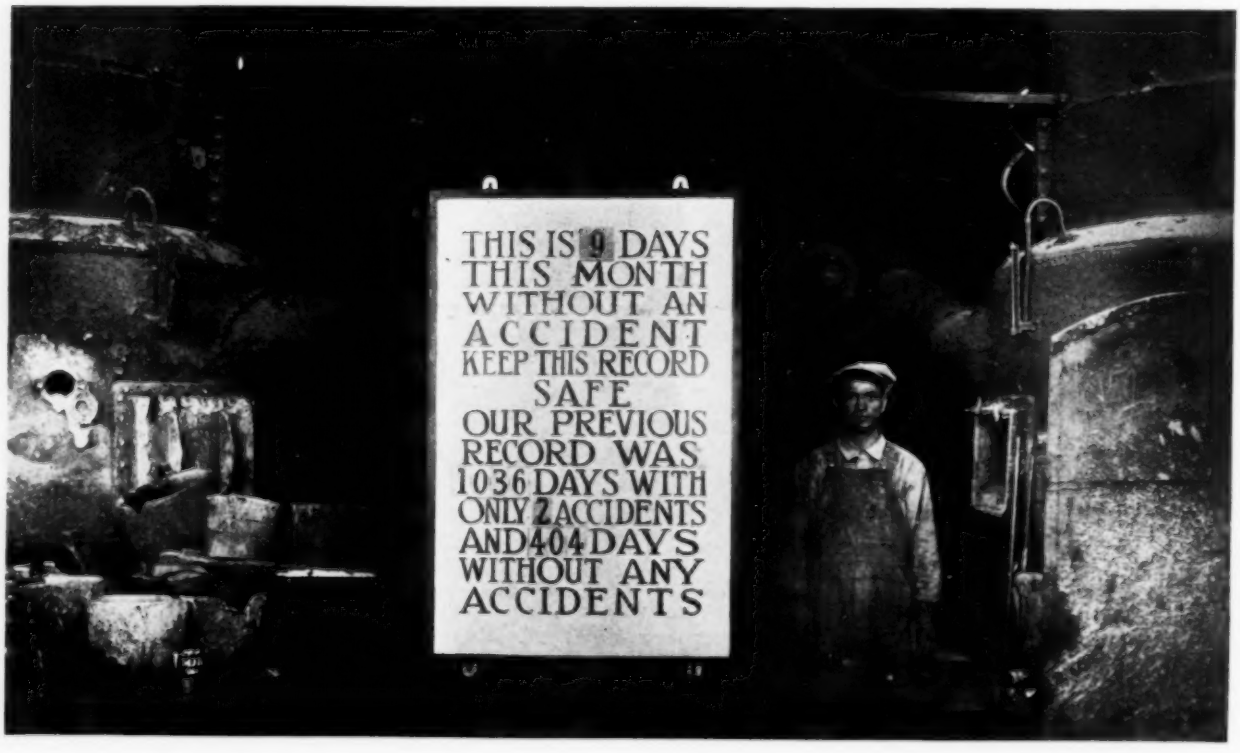
H. A. Mason is assistant to the superintendent of the Gould Coupler Co., Depew, N. Y.

The prizes will be presented at the 1929 convention.

The board also has announced that similar prizes will be given for papers presented at the 1929 Chicago convention. The plan provides for three prizes of $100 each for papers presented at the 1929 convention on any of the following subjects: gray iron, steel, malleable, nonferrous, sand control, and general foundry practice. Only one paper in any class will be awarded a prize.

Utah Foundry Has Enviable Record

THAT the hazard incident to foundry operation may be minimized to a considerable degree has been demonstrated in a highly gratifying manner in the foundry of the Utah Copper Co., Garfield, Utah, under the direction of T. F. Jennings. The reproduction of a large placard shows that 9 days of the current month have passed without an accident. Attention is directed to the fact that only two accidents occurred during a period of 1036 working days and that at one period, 404 consecutive days passed without any accident.



Explains

Manganese Steel Production *in the* Electric Furnace

By J. Trantin Jr.

MANGANESE steel as will be discussed is that of the austenitic type, ranging from 11 to 15 per cent manganese and from 1.00 to 1.50 per cent carbon, which was brought to light as a result of investigations conducted by Sir Robert Hadfield in England about 1887 and found its inception in the United States in 1892. Inherent toughness and wear resistivity are the outstanding features of this steel, which make it adaptable to certain classes of work. The characteristic of hardening under deformation is particularly responsible for manganese steel assuming a position of importance in fields where simultaneous resistance to shock and abrasion are encountered, as for example, crushing machinery and railway track materials.

Increasing resistance to wear of manganese steel under impact is due to its responsiveness to cold working; the degree and depth of hardness being proportional to the amount of work and force of impact. In instances where hard rock is crushed, the face of a manganese steel crusher jaw may be increased in hardness from about 200 brinell to 550 brinell; this surface hardness coupled with a tough interior forming a valuable combination. In view of this fact, current practice is to subject switch and frog points and intersecting corners on crossing and working faces of breast liners to a preliminary hammering operation so as to improve the characteristics at the point of maximum wear. In such instances the section is built up slightly to allow for reduction.

Describes Process

FOR certain castings where work hardening action takes place, manganese steel has been found excellent due to its wear resisting qualities. Developed by Hadfield in 1887, *its use has expanded to a considerable degree. However, its manufacture is a specialized field and the various phases entering into its production will be covered in a series of three articles of which this is the first. The author is associated with the Minneapolis Electric Steel Castings Co., Minneapolis, as metallurgical engineer.*

Although deviation from the original range in chemical composition has been slight, improvements in the process of manufacture have been introduced progressively. With but few exceptions, manufacturers have changed from the use of converter to the electric process, which is more reliable and conducive to producing a higher grade of steel. In view of this fact, discussions will be limited to electric steel.

A review of the electric process shows that several practices are employed at the present time, as follows:

Charging low carbon steel or wrought iron scrap and adding lump ferromanganese (generally preheated) after the melt-down.

Charging the same burden as above and adding molten ferromanganese a few minutes before tapping.

Charging low carbon steel or wrought iron scrap with manganese steel scrap and supplying sufficient ferromanganese (either lump or molten) after the melt-down to bring the manganese to the desired amount.

Charging a burden of low carbon steel or wrought iron scrap, manganese steel scrap and ferromanganese, and supplying either ferromanganese or silicomanganese to replenish the manganese lost as a result of chemical or mechanical means.

Charging low carbon steel or wrought iron scrap with manganese

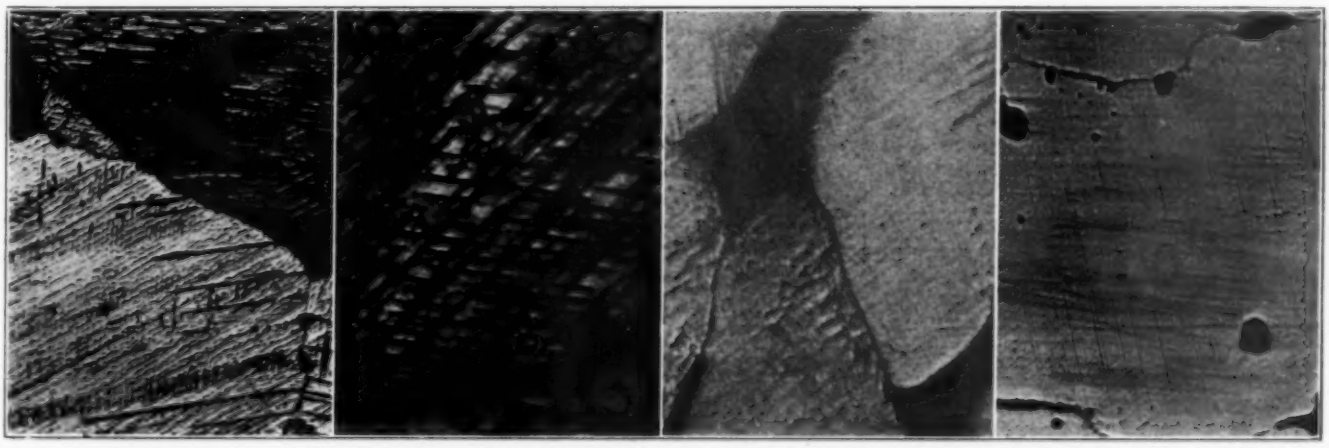


FIG. 1—MICROGRAPH SHOWING TRUE AUSTENITIC STRUCTURE. FIG 2—TAKEN FROM A SPECIMEN POURED AT 2590 DEGREES FAHR. FIG. 3—FROM A HEAT POURED AT 2625 DEGREES FAHR. BOTH FIGS. 2 AND 3 SHOW AUSTENITIC STRUCTURE BUT TENSILE TESTS ARE LOW. FIG. 4—EFFECT OF ABSORBED GASES AT GRAIN BOUNDARIES IS VISIBLE. ALL MICROGRAPHS ARE MAGNIFIED 750 DIAMETERS

steel scrap and adding ferromanganese after the melt-down.

Charging 100 per cent manganese steel scrap and supplying either ferromanganese or silicomanganese (dependent upon the carbon content) to compensate for loss.

Of the six methods mentioned, the last four seem to be in common favor, primarily because of the advantages obtained by the judicious use of manganese steel scrap. A brief discussion of the effect of using manganese steel scrap in the manufacture of manganese steel may be of interest.

Manganese steel made by melting the virgin metals, that is low carbon steel scrap and ferromanganese, possesses properties inferior to that made by the process in which manganese steel scrap forms part of the burden. In the case of the former, a coarse open-grained product is obtained which exhibits poor physical characteristics and fair wear resisting qualities. Beneficial effects, which are realized by making scrap additions, are manifested by increased density, tensile strength, ductility and resistance to abrasion. This may be due in all probability to the character of the carbides and the increased rate of diffusion. On the other hand, heats made by employing 100 per cent manganese steel scrap without proper precautions result in much grief both from the standpoint of breakage and inferior quality. During the melting and remelting of scrap certain melting and conversion losses take place while the nonoxidizable impurities, such as nitrogen and phosphorus condense themselves and gradually increase in percentage; the rate of increase being proportional to the number of remelts.

Other advantages derived from the judicious use of manganese steel scrap are:

Saving of power. The alloy of carbon, manganese and iron has a much lower melting point than wrought iron scrap and therefore, requires less power (heat) to reduce it to the molten state.

Increased life of refractories. By melting at a reduced temperature or at a high temperature for a shorter period of time, the reaction on the refractories is reduced, resulting in a saving of labor for repairing and permits longer life.

Alleviates danger of skulling. By adding lump ferromanganese to the bath or to the cold charge (if large chunks are charged) the danger of creating a skull presents itself. This danger is not encountered when using the manganese steel scrap in the charge.

The following standard practice instructions governing the manufacture of manganese steel suitable for railroad work and commercial castings such as wobblers, chain links, etc., which are subject to shock and vibratory stresses, exemplify common procedure in a 3-ton electric, basic-lined furnace.

Steel scrap charge for this grade of steel shall consist of manganese steel scrap (foundry returns and foreign scrap), carbon steel foundry returns and wrought iron scrap.

Alloys with the following requirements shall be used in manufacture:

Ferromanganese of the following chemical analysis: Carbon, 6 to 6.50 per cent and managanese, 75 to 80 per cent.

Silicomanganese of the following composition: Carbon, under 1 per cent, manganese, 60 to 80 per cent, and silicon, 20 per cent.

Ferrosilicon of the following composition: Carbon, 2 per cent, and silicon, 50 per cent.

Fluxing materials which follow shall be used in the manipulation of the heat:

Lime, (CaO) which should contain a minimum of 95 per cent CaO and less than 1 per cent of each of the following impurities: MgO, SiO_2, Fe_2O_3 plus Al_2O_3.

Fluorspar, (CaF_2) containing less than 12 per cent impurities.

Carbon in the form of powdered coke or pulverized electrodes.

Furnace charge of ferromanganese shall be divided into two parts. The first part constituting 75 per cent of the total charge shall be placed directly in the bottom at the center of the furnace. The second part shall be added at the finish of the heat.

Large pieces of manganese steel scrap shall be placed over the ferromanganese.

The remaining manganese steel scrap may be mixed with the balance of the burden, which shall consist of carbon steel returns and wrought iron scrap. Care should be exercised in charging the latter so that all ferromanganese and manganese steel scrap is covered, thereby producing good contact.

During the melt down all openings in the furnace shall be sealed as tightly as possible.

When the charge is about one-half melted, 75 pounds of lime should be added under each electrode and the current reduced to between 1000 and 1250 kilovolt-amperes.

Observations shall be made at regular intervals to determine the condition of the slag, which must be kept fairly heavy during the latter part of the melt down.

When the entire charge has been melted, the bath should be stirred thoroughly and a test taken from two parts of the furnace for preliminary determination. At this stage 35 pounds of ferrosilicon should be added and immediately thereafter sufficient lime and spar (6 parts lime and 1 part fluorspar) charged to create a heavy slag, after which the bath and slag should be rabbled followed by a heavy dusting of coke. The doors should be sealed as tightly as possible so as to maintain a reducing atmosphere necessary for the proper functioning of the slag. The bath should be allowed to work for about 15 minutes, after which time the bath and slag should again be rabbled. The operator should use his judgment as to further additions of lime. After dusting the slag with coke, the furnace should again be sealed. Observations as to the reducing condition in

Table I

Brick Requirements for 3-Ton Furnace

	Number Required
Bottom	
9-inch straight magnesite brick	780
No. 1 key magnesite brick	350
No. 3 key magnesite brick	525
Side Walls	
13½-inch straight metal encased bricks	190
13½-inch metal encased bricks	750
9-inch straight metal encased bricks	20
9-inch key metal encased bricks	30
Arches	
No. 1 arch silica brick	52
No. 2 arch silica brick	20
No. 3 arch silica brick	28
9-inch straight silica brick	40
No. 1 split silica brick	10
Featheredge silica brick	10
Roof (Hand Built)	
No. 1 arch silica brick	21
No. 2 arch silica brick	56
No. 3 arch silica brick	54
No. 1 wedge silica brick	62
9-inch straight silica brick	12
75's silica brick	384
76's silica brick	96
No. 1 split silica brick	16
2 Ts. skew back brick	67
Featheredge brick	16

the furnace should be made periodically. An occasional dusting of coke and lime (1 part of coke to 6 parts of lime) is the best means of maintaining this condition.

As soon as the result of the preliminary carbon test has been received from the laboratory, the additions of ferromanganese or silicomanganese are computed to bring the steel up to specifications. After making the proper additions, the bath should again be stirred and the slag dusted with coke.

After sufficient time has been allowed for the alloy additions to melt and diffuse and the slag allowed to function, the bath should again be stirred and a sample taken for temperature and bend test. The bend test is used as a check on the computed manganese and carbon content as determined from the preliminary carbon test. The degree of bend should be at least 120 degrees around a 1-inch diameter. If the bend is poor, further additions of either ferromanganese or silicomanaganese should be made. When a satisfactory bend is obtained and if the temperature is correct, the heat should be tapped. However, if further alloy additions are made, time must be allowed for diffusion and for the slag to work. Before tapping it is imperative that the slag be white; a carbide slag is desirable.

Correct pouring temperature of the steel, determined by the nature of the castings to be poured, should be checked with the foreman of the pouring floor.

If it becomes necessary, due to some emergency, to hold the heat in the furnace, care must be exercised by the operator to maintain proper reducing conditions and safeguard refractories against melting.

The following description outlines the method employed in making the bottom, and the construction of the walls and roof of a 3-ton heroult furnace employed in the manufacture of manganese steel.

In making the bottom a layer of dead burnt Austrian magnesite 1 inch in thickness is placed next to the furnace shell. On top of this two courses of 9-inch straight magnesite brick are laid flat; the second layer of brick obviously should be laid at right angles to the first so that all joints may be broken. Dry chrome cement should be used in filling the cracks. The next course of brick consists of 9-inch magnesite keys laid flat and placed around the circumference of the shell. This course is 3 brick deep, thus leaving a basin in the center approximately 42 inches wide. Each successive course of key brick is dropped back 2 inches until a point about 7 or 8 inches below the door sills is reached, where the remaining courses up to a point even with the door sills are built up straight. At this point the thickness of the bottom is about 13 inches. All bottom brick are laid in dry chrome cement and care should be taken that all joints are broken. A good grade of fire brick should be used in place of the magnesite brick that lay next to the furnace shell in the first three courses of brick.

Side walls are laid up with 13½-inch metal encased magnesite brick (both keys and straights). This lining continues from the top course of bottom brick to within 1½ inches of the roof. As stated before, the joints should be staggered and chrome cement used in laying the brick.

The doors in the furnace will be protected by a covering of brick consisting of jambs, sill and arch proper. The sill is formed by the brick in the top course of the bottom brick. Silica brick will be used for the jambs and arches proper. The arch is of the same depth as the furnace lining and consists of two courses of arch brick. The jambs are made of 9-inch straight silica brick extending the same depth as the furnace lining. The silica brick are laid up in silica base mud consisting of finely ground ganister and sodium silicate solution.

The roof is constructed of silica brick. When in service, the roof should be kept free from excessive dust so as to allow proper radiation of heat, thus insuring longer life. A layer of Austrian magnesite constitutes the seal between the side wall and roof.

In hearth construction either one of two types may be employed, namely, the rammed up or the sintered in. Although the former is the quickest and easiest to construct, the latter is preferable because of its reliability and permanence.

The first step in burning in the hearth is to provide a means of contact for the electrodes. This is best obtained by means of three pieces of electrodes about 18 inches to 24 inches in length being placed in the form of a star so that contact may be made with all three electrodes. The star should be elevated about 8 inches using magnesite brick as supports.

After the star has been set properly the power is turned on and the furnace is allowed to heat slowly for three or four hours using about 200 kilovolt-amperes at the start and gradually increasing the power to 400 kilovolt-amperes. At the end of this time the power is raised to 500 kilovolt-amperes and heating continued until the arches begin to glisten. The power is shut off and a mixture of 5 parts of finely ground Austrian magnesite and 1 part of basic open-hearth slag is spread over the bottom and along the sides to a thickness of 1 inch. The heating should continue at

Table V

Special Test Bars

Pouring Temperature	Tensile Strength
2750	135,500 lb. per sq. in.
2680	128,000 lb. per sq. in
2620	119,000 lb. per sq. in.
2590	112,000 lb. per sq. in.

Table II

Presents Chemical Requirements

Class	Carbon Min.	Carbon Max.	Silicon Min.	Silicon Max.	Sul. Max.	Phos. Max.	Manganese Min.	Manganese Max.	Chromium Max.
1	0.90	1.05	0.20	0.90	0.06	0.06	11.50	12.50	0.25
2	1.12	1.22	0.20	0.90	0.06	0.06	11.50	13.00	0.50
2	1.20	1.45	0.20	0.90	0.06	0.06	12.50	15.00	1.25

Table III

Gives Physical Requirements

Class	Ultimate strength lb. sq. in. min.	Elastic limit lb. sq. in. min.	Elongation in 2 in. per cent min.	Reduction of area per cent min.
1	90,000	45,000	20	25
2	90,000	45,000	20	25
3	95,000	48,000	15	20

Table IV

Results Obtained from Bars

Specimen No.	Chemical Analysis C	Mn	Si	Cr	Physical Test Ultimate lb./sq. in.	Elongation 2" per cent	Red. of area per cent
1	1.18	11.98	0.57	0.48	134,500	43.7	36.5
2	1.15	12.10	0.43	0.56	60,000	21.5	.....

500 to 550 kilovolt-amperes until the mixture of magnesite and slag becomes of a pasty consistency, when another layer of the above mixture is added.

This operation is repeated until the bottom assumes the shape of a deep bowl and the thickness of the bottom measures about 15 inches. Care must be exercised that the refractories are not burnt too seriously and that each successive layer of magnesite and slag is sintered properly before another is added. The star electrodes must not be allowed to bake into the bottom. To obviate this condition it is necessary to roll them aside from time to time and fill the impressions with the magnesite-slag mixture. When the final addition of bottom material has been made and properly sintered in, a charge of steel is put into the furnace and melted to set the bottom finally and remove foreign particles. This melt is known in foundry parlance as a wash heat. The furnace is now ready for melting.

Use Good Patching

In patching the bottom and slag line after each heat a dolomite base patching should be used except in cases where deep cuts occur in the bottom. When this condition exists, the cuts or holes should be scraped thoroughly and filled with the magnesite-slag mixture with a protective covering of lime.

The silica brick jambs and arches should be patched with a silica base mud. In the case of a seriously cut condition of the jambs, a mixture of 5 parts of magnesite to one part of chrome cement, moistened with sodium silicate solution should be used. The side walls may be patched with a mixture of magnesite and fire clay. A special block silica roof was used.

The bottom of the basic lined tea pot ladle is first lined with two layers of 9-inch straight fire brick, the second course being laid at right angles to the first so as to break the joints. The sides of the ladle are lined first with split magnesite brick laid up in fire clay and chrome cement mud. A mixture consisting of Austrian, dead burnt magnesite and fire-clay (20 parts magnesite to 1 part clay), moistened to insure adherence, is rammed over the brick to a thickness of about 3 inches. A special mixture of 4 parts of that mixture to 1 part of chrome cement is used in ramming in the top of the spout.

After the lining has been completed, the surface should be washed with a mixture of 1 part of chrome cement and 1 part of sodium silicate. The drying process should commence slowly by first building a wood fire for about 2 hours, after which an oil fire should be applied with increasing intensity of heat for at least 4 hours. A better procedure in the initial drying is to allow the lining to air-dry for a time. A mixture of 1 part of magnesite, 3 parts of ground fire brick or ganister and 1 part of sodium silicate serves as an excellent patching material for the lip. For patching the interior of the ladle, the original mixture should be used.

The bottom of the stopper ladle is laid with fire brick the same as the tea pot ladle. A course of 1-inch split fire brick is laid next to the shell. Over this is placed a layer of 9-inch straight fire brick laid flat, and then a layer of split fire brick. All bricks are laid up in fire clay mud. The entire lining then is coated with a thick slurry of fire clay mud. Drying instructions are the same as those given for tea pot ladles.

Care must be taken with the fitting of the nozzle with the stopper and with the seating of the nozzle in the ladle. The proper method of fitting the stopper into the nozzle is by rubbing down the stopper to a good bearing. This should be done before the stopper is placed on the rod. A small quantity of sharp sand sprinkled around the stopper will facilitate fitting. After the nozzle and stopper have been fitted, the nozzle is placed in the ladle. It must be set plumb and level in place and carefully mudded up. Care must be taken in fitting the stopper on the rod so that the stopper pin is protected from the steel.

Gives Different Types

Manganese steel may be classified into three main divisions according to its application and the conditions to be encountered. As a matter of reference we shall designate the divisions as classes 1, 2 and 3.

Class 1 is intended for such parts where extreme toughness is desired and where hardness is of secondary importance, such as crane wheels, sheaves, guard rails, etc.

Class 2 is suitable for castings where rolling friction or shocks and vibratory stresses are encountered and where strength, ductility and wearing qualities are prime consideration, such as railroad switches, frogs, and crossings, excavating and elevator buckets, rolling mill pinions and wobblers, chain links, etc.

Class 3 is particularly adaptable where a great amount of abrasion is encountered and where ductility is of secondary importance, such as crusher jaws, ball mill liners, safe doors, grinding balls, plow shares, pipe balls, etc.

Chemical requirements are given in Table II. Physical properties listed in Table III were based on results of bars cast to shape in cores to a diameter of 0.570 inches along the gage length. The bars were then quenched individually and ground to a diameter of 0.505 inches for testing.

Manganese steel when properly heat treated is nonmagnetic and by virtue of this fact it is used extensively as a protecting plate for lifting magnets. With the carbon and manganese at the upper limit in class 3 excellent heat resisting properties are obtained, such as are required for mandrels or pipe balls in the manufacture of welded pipe. Results of extensive tests on pipe balls have shown that hardness plays an important part in wear resistivity, which is obtained in the high carbon steels containing free cementite.

Lists Many Factors

In the manufacture of manganese steel castings many factors must be taken into consideration and properly adjusted in order that failures in service may be minimized. Among these may be listed the following: Design, chemical analysis, method of alloying, finishing and pouring temperatures, foundry practice and heat treatment.

The inherent property of great shrinkage, characteristic of high percentage manganese steels, is the cause of considerable grief to the foundryman. In view of this fact the engineer should take into consideration the peculiarities of the steel in making his design. Sharp corners should be avoided where it is permissible to substitute fillets. Likewise, the sections should be as uniform as possible so as to permit uniform cooling, thereby minimizing the formation of hair cracks. Owing to the poor heat conductivity of manganese steel, it has been found that the effect of heat treatment extends approximately 1½ inches below the surface. Castings in which the thickness exceeds 3 inches are likely to develop cracks because of strains set up in the carbide-rich interior. Even through cracks may not manifest themselves immediately after pouring, they are likely to develop in service, particularly when the castings are subjected to shock or repeated stresses.

For the general run of work where

a steel possessing shock and abrasion resisting qualities is required, it has been found that the manganese-carbon ratio (which should be between 10 to 1 and 12 to 1) plays an important part. It also is important that the manganese content should not fall below 11 per cent. The range between 6 to 10 per cent is characteristically martensitic, which is a hard and brittle constituent. Martensitic steels, when subjected to shock, will not submit to cold working readily since they have a tendency to *flake* or chip because of lack of cohesiveness. Likewise, a high carbon content may be detrimental in that free carbides may be present which promote a weakened condition and cause flaking, cracking or chipping.

Add Alloys in Furnace

The rate of dissemination of alloying metals throughout the steel is dependent upon: The melting point of the metal or alloy, size and shape of material, difference in temperature between the bath and metal or alloy, degree of agitation, and the chemical affinity of the steel and alloying elements.

The proper place to add the alloying elements is in the furnace rather than in the ladle because all the factors mentioned readily can be controlled. It is poor practice to make additions of solid metals or alloys (if in lump form) in the ladle because the rate of diffusion is slow even though sufficient time for melting or combining be allowed. Agitation in the ladle cannot be accomplished satisfactorily. In the case where the alloying elements were added to the ladle in the molten condition, only fair results may be obtained.

Manganese steel must be refined properly to secure maximum quality. To gain this end the metal first must be heated sufficiently to drive off the harmful gases, such as oxygen, nitrogen and hydrogen, for which iron and manganese have a great affinity, particularly in the molten condition. Secondly, the steel must leave the furnace at a high temperature to impart mobility of fluidity, which is essential in permitting the slag and other impurities to rise to the top. Fluidity and the time element determine the rate of expulsion of impurities and without these factors a clean metal cannot be procured. Third, the steel must be poured into the molds reasonably hot to retain fluidity, thereby enabling washed sand to rise to the surface or into the risers.

To substantiate this contention a series of tests were conducted extending over a number of months. Fig. 1 shows a true austenitic structure, such as should be found in manganese steel properly heat-treated. It may be noted that slag and gas inclusions are minute. The temperature of the steel when tapped was 2950 degrees Fahr. and at the time of pouring was 2825 degrees.

In contrast to the above, Fig. 2 represents a specimen taken from a heat poured at 2590 degrees Fahr. and a tapping temperature of 2750 degrees. Fig. 3 is representative of a heat tapped at 2800 degrees and poured at 2625 degrees. Although an austenitic structure is revealed in these two cases, indicative of proper heat-treatment, the tensile strengths were extremely low, due to inclusions indicated by the dark areas. The chemical and physical characteristics of samples 1 and 2 are given in Table IV.

Pour Special Bars

To further substantiate the theory advanced that a decrease in pouring temperature proportionately decreases the tensile strength, particularly when the metal is allowed to cool in the ladle to a low temperature, test bars were poured from the same pot at intervals. The procedure was to teem approximately 100 pounds of steel into a small bull ladle and pour the bars at intervals, thus allowing the steel to cool gradually. The results are given in Table V.

It will be noted that a drop in temperature of about 150 degrees in this instance shows a material reduction in tensile strength amounting to approximately 20,000 pounds per square inch. This does not necessarily mean that a low pouring temperature impairs the strength of the steel, but it does show that the steel becomes weaker upon being exposed to the air for a time due to absorption of gases, the degree of absorption being proportional to the exposed surface and the time element. Fig. 4 was taken from the bar which was poured at 2590 degrees. The effect of the absorbed gases at the grain boundaries may be noted.

After the metal has been finished properly in the furnace another problem confronts us, namely, that of producing a sound casting. Owing to the great number of variables that present themselves, this intermediate stage of the process probably requires more careful supervision than any of the others. The variables referred to include the following: Condition of the cores, condition of facing and heap sand, treatment of the molds, methods of gating, and treatment of the castings after pouring.

Should Foundrymen Agree to a Code

(*Concluded from Page 7*)

and cutting the original estimate.

The identity of many of the problems properly within the scope of a trade practice conference is remarked by E. E. Walker, president, Erie Malleable Iron Co. However, he sees the difficulty of attempting a general presentation of trade practices for the entire industry. He says:

> My own opinion is that the problems of the gray iron, steel, malleable and nonferrous foundries are identical and at first thought it would seem that a concerted action should be taken. However, I fear, from the various hearings that have been held that it requires a very large proportion of all parties interested to obtain a hearing, and, this being the case, it might make it very difficult to produce sentiment along these lines within any reasonable length of time. With this thought in mind, I believe that it should be taken up by the more compact industries, such as the malleable and steel, first.

R. R. Fauntleroy, president, Moline Malleable Iron Co., St. Charles, Ill., holds a similar opinion. He says:

> May I suggest that I believe the foundry industry is so extensive that it would be very difficult, if not impossible, for it as a whole, to hold a meeting with the federal trade commission and that it would be better for the component parts, such as the Malleable Iron Research institute, the Steel Founders' Society of America and the Gray Iron institute, and if there be an association among the nonferrous foundrymen, to prepare their resolutions and to have their individual meetings with the commission.

W. E. Dunn, secretary, Southern Metal Trades association, Atlanta, Ga., believes that a general conference would be advisable. He says:

> Regardless of who or what commission does it, if it can be done, I think that uniform foundry trade practice is the one thing most essential to profitable foundry operation, and if the federal trade commission can bring about uniform trade practice among the foundries, our savior of the foundry world has been found.
>
> We would be willing to assist all possible in getting up such a conference of the entire foundry industry, if it is decided to call the same.
>
> Please don't forget, we are still here, right in the heart of the South and that the southern metal plants constitute a fair percentage of the foundry industry of America.

Further comment serving to develop thought on this important subject will be welcomed. A number of the trade associations serving the foundry industry have appointed committees to study the problem.

Iron and Steel Industry *Needs* Unity of Effort

By G. H. Charls

PRIMARILY, a trade association or trade institution is the device by which an industry progresses. It promotes the science of contact, the weighing of facts and the measuring of economic trends. Associations are essentially factual organizations. They assess the values of past experiences for future guidance.

Through the operation of associations, executives see in advance the consequences of their deeds and behavior. They secure the complete knowledge that a group survives in competition with another group according to its unity and the ability of its members to co-operate for a common end. Executives learn to crystallize, simplify and unify practices, sane opinions and right judgments and to detach themselves from the unintelligent habit of forming judgments according to likes and dislikes. They discover what may be accomplished through collective effort and realize the beneficial results.

Executives learn to organize intelligence, initiative and enterprise; to engender certainty and stability and to keep pace with the rapidity of developments. They also learn to substitute facts for guesses; wisdom for ignorance; caution for blind willfulness; tolerance for vindictiveness; faith for distrust; discourse for antipathy; analysis, research and scientific formula for assumption, conjecture and surmise.

There is no short cut to stabilization of an industry. Facts and the causes of unsatisfactory conditions must be faced squarely, recognized and understood. With this knowledge, the units of that industry must unite and co-operate to obtain a true knowledge of what is ethical and unethical, economical and uneconomical, and persistently strive for the attainment of the one and the elimination of the other. This is possible only through group action.

The most pernicious cause of inadequate return on invested capital in an industry, and the one which has been and should be emphasized, criticized and condemned most sharply, is an ignorance of the cost of doing business, or the willful disregard of such cost as is known, when a commodity is priced. Chiefly allied with this prime cause is the absence of market research and analysis to measure demand, coupled with the blind, unthoughtful attitude which blocks the way to the collective group effort to expand such demand.

Helping Industry

THE trade association offers the most promising device for furthering and stabilizing industry, according to this article which is abstracted from a paper presented before a meeting of the Malleable Iron Research association. The author, G. H. Charls, is president of the Flat Rolled Steel Manufacturers with headquarters at Cleveland.

Abram F. Myers, chairman of the Federal trade commission, has said: "The proper pricing of products is naturally the first concern of the business man and one on which he needs all the information and help he can get. It is a serious mistake for the individual or an industry to permit competition to price its products without any regard for the cost of producing such products."

In these quandaries, the strong must guide and help the weak, or be crippled and perhaps destroyed by unintelligence and misbehavior. The strong must assume leadership, for only the strong can influence and dominate by precept and example, and lead an industrial group out of the slough of jungle competition into the knowledge of the fundamental requirements of modern business.

It must be kept in mind that a trade association is only a means to an end. Without the active participation of its members, their enthusiastic support, thought and effort, the association will become a joke. On the other hand, when the members become conscious of the necessity and the possibilities of group action and apply their intelligence vigorously to the problems of the industry, a trade association becomes the finest, in fact, the only possible means of self regulation in industry.

It is in effect a mighty bridge, leading from the medieval conception of business to the loftier principles and economic truth of modern times. However, the factor of safety in this bridge is low. It is not built for a dead load. An inert mass will cause it to give way and crumble. It cannot carry inactivity and indifference. It is a bridge of transition and those who cross it must keep moving, conscious that it is a way of service. The best minds and highest authorities recognize trade associations as an integral, permanent part of our modern business structure.

To achieve an enduring unity of effort, such as our modern economic life demands, will of necessity require time, but it will be a monumental work if each and every association member will recognize that he shall not be permitted to take his ease, but that he will be required to spend his days in unremitting toil to acquire constructive unity of effort and to hold it after it is acquired. Then, and then only, will the industry stand as the mighty oak—staunch, unyielding, reliable, under all conditions.

The government is attempting to co-operate and to be helpful as never before. There is a momentous reversal of attitude on the part of the Federal trade commission toward association work. During the past year, many successful trade practice conferences have been held.

From our perusal and analysis of the decisions handed down in the trade practice conferences with the

millwork industry, hickory handwood-turning industry, cottonseed oil mills industry and the flat glass industry, it seems obvious that a constructive piece of work is being done.

Insofar as we are able to determine from the regular and irregular sources of statistics, the answer to the question, "How is business?", is: "Good for the present and the first quarter." If this question was "How are profits?", the answer would probably be that the iron and steel industry has been so irritated by auburn figures—5 per cent return may be termed "auburn"—that it is beginning to shy like a colt when it sees a redheaded girl.

A chart issued by the National Industrial Conference board, tells a wonderful story of sales achievement. Note the automotive industry, operating at the rate of 68.8 per cent of capacity in 1926; 70.3 per cent of capacity in 1927; earning at the rate of 22 to 30 per cent. Then note the steel industry, operating at the rate of 75.1 per cent in 1926; 68.8 per cent in 1927; earning 4½ to 5½ per cent on its invested capital.

Is a Challenge

If the iron and steel industry is governed by equal intelligence, and we know it is, how long will it permit its average earning power to remain little better than the return on a safe government bond? When will it recognize and regulate the cause behind the effect? Is not this chart a challenge to the ingenuity and the will to do of all steel producers?

The will to do in an industry unquestionably must be preceded by the interest and the desire to do. Interest and desire, in turn, must be inspired by a collectively accepted ideal—The vision of what ought to be.

Applying this psychology to percentage of profit, which must essentially be based upon a true knowledge of the cost of doing business, the question arises, What ought to be the profits in an average industry in normal periods of prosperity? It is estimated that the average per cent of all industries in the United States is 10 per cent.

It is any more than common sense for the members of an industry to find a unanimity of interest and desire to do as well as the average?

Is it any more than simple intelligence to aspire to such an ideal, such a vision of what so decidedly ought to be? Of course it is not, and yet otherwise intelligent executives seem astonishingly unaware of the ridiculous and really tragic attitude they manifest in the conduct of their business. In their madness and frenzy, they proceed to pull down the supporting pillar of the temple of prosperity, incoherently mumbling the words "Tonnage, tonnage, tonnage."

Apparently possessed, they pursue the shadow of capacity operation and crucify the substance of a sane, average profit on the cross of unintelligent, unreasonable, destructive competition. All ethical and economical thoughts and ideas are thrown to the four winds. They seem to think that business is simply a warfare to eliminate competitors and to establish the survival of the fittest.

Machinery and the utility of a product will function naturally and in an orderly manner to establish which shall and which shall not survive. To conduct a profitable business in an industry, it is necessary for the industry to be manned by executives actuated and prompted by something loftier than the code of animals—not by ruthless price cutters who ridicule and deny a place to finer ethics and to collective economical judgment.

They are the babbitts of industry—isolationists—blind to their own best interests—lacking the resourcefulness to shoulder the responsibility the modern business executive owes to his workers, his stockholders and the public. They are the obstacles making impossible the achieving of that unity of effort to hold a nation prosperous, which economic life demands.

The iron and steel industry must come to a fuller realization that only that industry will successfully prevail which resolves to correlate its effort in recognition of the principle that, the prosperity of the whole is the individual's greatest opportunity for progress.

It has become axiomatic that the industry which does not recognize this principle will leave its individual units a pitiful prey to economical forces beyond their intelligence and power to combat.

Herbert Hoover, when secretary of commerce, wrote into the 1927 year book of the department of commerce:—"Trade associations have made a most valuable contribution to our economic progress . . . . Within the last few years, they have rapidly developed into legitimate and contructive fields of utmost public interest and have marked a fundamental step in the greatest evolution of our economic life."

The progressive executive today is keenly alive to the beneficial results which may be accomplished through collective and associated effort because it has come to pass that only through such associated efforts can there be consummated for the good of the whole, the forging of unified practice—the creation of right opinions and sane judgment. The greatest hope for the future lies in the fact that he swears allegiance to the dictum that only through spending his days in unremitting toil for the good of the whole industry can he find his greatest opportunity for success.

Book Review

Die Betriebspraxis der Eisen-Stahl- und Metallgiesserei-Heft 7-Die metallurgischen und metallographischen Grundlagen des Gusseisens, by K. von Kerpely, paper or cloth, 120 pages, 6½ x 9½, published by Wilhelm Knapp, Halle (Saale), Germany, and supplied by THE FOUNDRY, Cleveland, for $3 in paper or $4 for cloth. In London the book may be obtained from the Penton Publishing Co. Ltd., 416-17 Caxton House, Westminster, for 15s in paper and 20s in cloth.

This volume is the seventh of a series covering works practice in the iron, steel and metal foundry compiled under the direction of Hubert Hermanns, and relates to the metallurgical and metallographic foundations of cast iron. Chapter I is devoted to a discussion of the structure of cast iron with numerous diagrams and illustrations to aid in visualizing the matter under discussion. Chapter II describes the influence of silicon, manganese, phosphorus and sulphur upon the structural properties of cast iron and refers to the work of such investigators as Gontermann and Oberhoffer, Honda and Murakami, Heyn and Bauer, Wuest and Peterson, Hatfield, Hague and Turner, and many others. In chapter III the author discusses the origin and influence of graphite on the structure of cast iron. Reference is made to the work of Tamman, Goerens, Heyn, Northcott, Hailstone and Piwowarsky's investigation of the effect of high temperature melting. Meyer's further investigation of Piwowarsky's process is mentioned. Chapter IV is devoted to the influence of some elements upon the structure properties of cast iron, and relates the investigations carried on by Sipp and Diefenthaler on pearlite cast iron, the work of Maurer and that of Greiner and Klingenstein. Reference also is made to the effect of titanium, aluminum, manganese, nickel and chromium. Chapter V deals with the mechanical properties dependent on structure and treatment. In chapter VI the author discusses shrinkage of cast iron, and chapter VII deals with the growth of cast iron.

Fig. 1—Clear, Shadowless Lighting and Excellent Ventilation Are Secured in This Foundry

Good Ventilation Aids Production

By G. S. Hamilton

A VISIT to some of the newer foundries of the country will show how much progress has been made in lighting and ventilating the modern casting plant. Foundrymen have proved to their own satisfaction that air and light have a direct relation to foundry efficiency. They have found that it is necessary to have a well lighted and well ventilated plant to produce castings at a profit. Workmen must be able to see and breathe easily to work well. When men have a clean, well lighted foundry floor they stay on the job and thus good working conditions reduce the labor turnover.

The design of a foundry building is of greatest importance as it helps or hinders production. The shape of the building, design of the roof, placement and style of windows must be suited to the ground area, the floor layout and various foundry operations. The equipment and layout determine the tonnage of metal which may be cast. However, the quantity of metal handled determines the amount of heat and smoke produced and unless the heat and smoke are carried away quickly the men are hampered in their work, and the theoretical tonnage is made impossible in practice. As a matter of fact, the foundry is no better than its ventilating system.

In the older foundries, the building was regarded as a chimney, the heated air was expected to move upward uniformly. The roof was made as high as practicable with a steep pitch toward a center monitor to move this air. Tradition and the limitations of oldtime windows kept this monitor small and the air inlets below were of haphazard construction. Actual practice in many cases showed that the chimney type building was inefficient. Heated air did not move upward fast enough to ventilate the building. There was a tendency for smoke to hang and choke the interior, filling the foundry with noxious gases that slowed up production or drove the men from their work.

However, it is possible to take advantage of natural laws in providing adequate ventilation for foundries. This may be accomplished by providing sufficient window openings to permit the heated air and smoke to leave and fresh air to enter the foundry freely. Roof slopes should be arranged to help rather than hinder the natural circulation. Also, to increase the efficiency of the workmen, enough windows, properly located, should be provided to permit natural light reaching all the working spaces.

Many foundries now are securing proper ventilation by using roof design developed by Clarke P. Pond, David Lupton's Sons Co., Philadelphia. This roof design is the result of intensive investigation of the light and air problems in foundries. When properly applied, it has been found to be an effective means of giving good natural lighting and ventilation to foundries, with a consequent increase in production efficiency.

The general shape of that roof design is indicated by the letter V as shown in Fig. 2. By inverting the customary roof shape, two high peaks are provided into which the heated air of a building naturally rises. This air movement is helped by the upward slopes of the roof and the air is directed toward the openings provided by continuous windows placed on the vertical-sloping sides of the roof truss.

A foundry building with this roof design is built only high enough to accommodate the traveling cranes and to provide the necessary outlet area and inverted roof shape. In such a building the heat streams travel the shortest practicable path and rise well above the breathing level before dif-

fusion begins. When the windows are open the lower air is clear. For the best movement of air, the inlet areas should be equal to the outlet areas, and the inlets should be kept low, especially in summer.

Top hung continuous windows of type designed by Mr. Pond are important features of the roof design. They are made of solid steel sections and are hinged at the top edge so that they may be swung outward and upward, resembling a glass awning when open. In this way they form a translucent rain-proof shelter over long openings and may be kept open for full ventilation regardless of weather conditions. These windows generally are made in continuous runs of 100 feet or more by joining standard length units with weather-proof joints. The windows overlap stationary glass panels at each end, thus preventing rain from entering at these points.

The location of the continuous windows in the sides of the truss, furnishes lighting through a wide angle and also throws a portion of the light against the slopes of the roof, which results in a breaking up of the light rays and a more widespread diffusion of the light. The combination of crossing rays, high glass area and reflection from under roof slopes produces an even lighting.

The roof design makes use of the low-intensity morning and evening rays of the run, no matter in what direction the building may face. Where this type of roof is used, there is no necessity of locating the building with the roof glass to the north. As the lighting is from practically all sides, hard shadows are absent, and workers can see clearly even when facing the windows, because of the light from behind.

This roof design also may be applied successfully to wide buildings. Two or more inverted roof trusses may be placed in parallel lines over the heat-producing areas and A-frames located between the inverted roofs to serve as lighting and ventilating inlets over portions of the floor where no heat-producing work is carried on. Experience has shown that by the proper application of this principle of alternate inlets and outlets a building may be of any length and width and still be ventilated thoroughly and lighted uniformly. For example the assembly plant at Chicago of the Ford Motor Co., which is 500 feet wide by 1360 feet long, is arranged with four sets of inverted roofs and five rows of A-frames. It is remarkably well lighted and ventilated throughout.

The roof design is varied to meet the particular need in high or low buildings. For its correct and most efficient use, the proportions of trusses and A-frames should be worked out for each particular case, taking into consideration column spacings, clearance heights, crane requirements, heat produced and the intended use of the buildings. The roof design has been used in a great many foundries throughout the country, including such companies as the General Electric Co., Ford Motor Co., Lunkenheimer Co., Fairbanks, Morse & Co., and General Motors Corp., upon the recommendation of such engineers as Frank D. Chase, H. M. Lane, Albert Kahn, C. A. Hardy and others.

Another feature of the continuous type window is that they may be controlled readily in groups by mechanical operating devices. A well known mechanical operator works on the tension principle of transmission which gives a flexible application of power. With windows thus controlled the ventilation becomes systematic and is not left to the individual whims of workers, nor is local ventilation determined by each worker.

FIG. 3—FOUNDRY BUILDING 140 FEET WIDE AND 450 FEET LONG DESIGNED TO PROVIDE GOOD VENTILATION AND PLENTY OF LIGHT

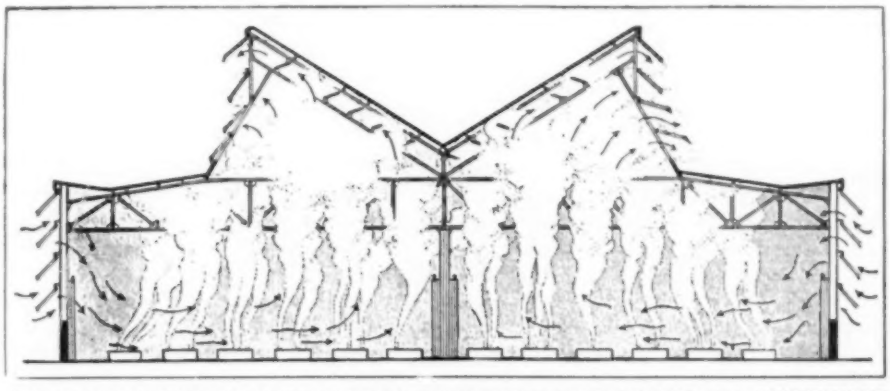


FIG. 2—CROSS SECTION OF A FOUNDRY WITH THE V ROOF DESIGN AND CONTINUOUS WINDOWS. ARROWS SHOW THE CURRENTS OF AIR

Describes Purpose

The purpose of the Gray Iron institute was presented by Arthur J. Tuscany, manager, before a meeting of foundrymen at the Manufacturer's association, York, Pa., Dec. 13. B. H. Johnson, Cresson-Morris Co., Philadelphia, vice president of the institute, and Albert E. Walton, Eastern representative, also attended the meeting. A similar gathering was held, Dec. 14, at Reading, Pa., at the Berks County Manufacturer's association.

Hold Meeting

Dr. Edward Marbaker, Mellon Institute of Industrial Research, addressed the Chicago Foundrymen's club on Dec. 8 at the City club, Chicago, on the results of his survey recently completed regarding cupola practice, uniformity in charging coke, oxygen control and analysis of gases in the cupola. The meeting had the largest attendance of any similar session of the club in recent years. A delegation of Milwaukee foundrymen came for the meeting by special train. Among the other speakers was: S. T. Johnson, president, S. Obermayer Co., Chicago, and president of the American Foundrymen's association, who advocated close co-operation between the national association and local clubs. C. E. Hoyt, executive secretary of the association also spoke.

Metals and Melting

How Metallurgical Problems Have Been Solved in Gray Iron, Malleable and Steel

Make Many Castings

Question—We have two jobs with which we are having considerable trouble and wish to ask your advice in overcoming our difficulty. One pattern is a round drum head for a vault. This job goes on the front of the vault and is highly polished, consequently any slight defect in the iron is brought out prominently. We have had about 50 castings from this pattern and have gotten only six or eight perfect ones, the balance being slightly porous or sand flecked in spots near the fillet. Four heavy lugs are cast on the face of this drum head and we are under the impression that this tends to draw from the thinner part of this drum nearest these lugs, this being the spot where the dirt flecks appear after casting is machined.

The average analysis of the iron shows silicon, 2.75 per cent; sulphur, 0.06 per cent; phosphorus, 1.0 per cent and manganese, 0.5 per cent. This iron is satisfactory for the great bulk of our work and we, of course, cannot change our entire heat for this one small job.

The other job is a large head for a laundry machine. The two legs on this head have a heavy rib attached to them which cracks after casting becomes cold. This difficulty occurs spasmodically only—comes cracked for a week or two and then becoming solid again. We weld all of these castings that become cracked and our customer does not complain but the high cost of welding material causes us to be concerned somewhat.

Answer—In the first place, the silicon in your iron is rather high and you could make better castings as well as save money on the purchase of pig iron by using an iron which would give you approximately 2.25 per cent in the casting. You would also be benefited by using a lower phosphorus iron with higher manganese. If you do not desire to change the iron in the entire heat, a special charge or two could be put in the cupola either at the start or at the end of the heat, and poured into these castings.

In taking up the specific problems you mentioned, we would suggest that you use a chill on the round drum head at the point where the casting is porous. This chill, or rather denserer, as metal with 2.75 per cent silicon would not be chilled by an iron chiller approximately 1½ inches thick, would close the grain of the iron and be a makeshift. The trouble appears to us to be with the sand and the way it is handled, but we could not tell this definitely from the information you give in your letter. The cracks in the head for the laundry machine are due probably to the temperature at which the iron is poured. Try pouring this at as high a temperature as possible.

Average Loss Not Known

Question—Kindly let us know what is considered an average melting loss in cupola operation.

Answer—As far as we are able to determine the average foundry loss in melting iron is less than 6 per cent. However, this also includes loss from ladle drippings and other miscellaneous losses of metal in the shop. Practically no foundry determines the loss in direct melting, which would be considerably lower, probably 3 per cent.

Stoveplate Cuts Sand

Question—We are having considerable trouble with our iron cutting when poured into stoveplate molds. We have tried all kinds of sand, but failed to eliminate this trouble. Could it be anything in the iron mixture which might cause this? We use some foreign scrap while we note that some stove foundries use straight pig iron. Could the use of scrap have anything to do with the cutting?

Answer—We do not know of any reason why one grade of stoveplate iron should cut the sand in the mold more than another and suggest that you look to the sand or the method of molding and gating. The sand should be free venting but should not be rammed too loose.

There is no reason why a straight pig iron mixture would be better than a mixture using approximately 40 per cent returned scrap from the same mixture. However, objection might be found to using foreign scrap on account of the possibility of getting an iron with high sulphur and not being able to determine exactly the average percentage of silicon in the scrap. Trouble due to oxidation would also be encountered if burned stoveplate scrap were used in cupola.

Cast Shaft in Roll

Question—Our foundry has been called upon to make a hard-iron roll about 4 inches in diameter and 2 feet long with a 1½-inch cold rolled shaft through its entire length. We would like to know if you could furnish any information in regard to the mixture that should be used to obtain a white iron roll and whether or not a mixture of this kind can be run through the cupola along with other charges of regular gray iron, running about 2.35 per cent in silicon, without detriment to the latter. Our cupola is lined to 44 inches inside diameter. Our regular charges consist of 1600 pounds, although in running a special mixture for these rolls, we have used two 1000-pound charges along with the regular charges, as this amount gives us the necessary iron for the day's output of these particular castings. We also have had trouble with blowing although we have heated the chills or shafts before placing them in the molds and have also painted them with creosote as we understand that this is done in many foundries on similar kinds of work. It is, of course, understood that the shafts are cleaned before using.

Answer—The main requirement for iron for a roll such as you mentioned is that the silicon is low, around 0.7 per cent; sulphur should not be above 0.12 per cent and phosphorus should be around 0.3 per cent although a higher phosphorus may be used without great detriment. Manganese should be between 0.5 and 0.6 per cent. If two 1000-pound charges were added at the end of the heat and the first iron of these charges was pigged together with the last iron of the regular charge you would get a fairly good separation. An extra split of coke between the end of the regular charges and the beginning of the special charges will show the point of demarcation between the two. If the shaft is well cleaned so that it is entirely free from all rust and is only slightly warmer than the mold it should not blow. However, an added precaution would be to coat the shaft with a thin solution of water glass which has been thickened by the addition of litharge. This should be thoroughly dried before the shaft is put into the mold.

Find Brass Foundry Costs

A Proposed Flexible System of Accounting Includes Few or Many Items from Which Accurate Knowledge May be Secured According to One of Several Methods

ADOPTION of an accurate cost system was recognized as a fundamental feature in the successful functioning of the Associated Brass Founders of New England, a recently formed association of men engaged in the production of nonferrous castings and a branch of the foundry industry which up to the present has displayed a considerable degree of apathy on the subject of costs.

Iron foundries, steel foundries and malleable foundries in the past have devoted time to the development and application of cost systems, but recent action of the brass founders in the New England district is one of the first of the kind to be inaugurated by men engaged in the nonferrous casting industry. This is all the more remarkable in view of the fact that brass foundries, as shown in the 1928 compilation of Penton's Foundry List, constitute the second largest group in the casting field. The number of iron foundries in the United States and Canada is given as 4243, brass foundries 3547, steel foundries 369 and malleable iron foundries 204.

Many Are Departments

Many of these brass foundries are listed as departments in general manufacturing plants or as adjuncts to gray iron foundries. The number of exclusive nonferrous foundries operated as individual units for the same time and in the same territory is given as 1495, or almost one-half of the total number. Naturally, many of those operated as departments of large plants have submerged their identity to the extent that their operating costs have been lumped under a few main headings. The result may not be strictly accurate in detail, but they are regarded as sufficiently accurate for all practical purposes.

Manifestly this practice is not suitable for the ordinary jobbing foundry with a long list of customers and an almost infinite variety of alloys to meet the varied requirements of these customers. Practically all the brass foundries in New England are in this class and their recent action in developing and adopting a workable cost system represents a sentiment that has been crystallizing for many years. With an accurate or even approximately accurate knowledge of costs, it is felt that the menace of ignorant competition will be removed from the field.

In Three Parts

Credit for working out the details of the system goes to Howard Stockwell, Barbour Stockwell Co., Cambridge, Mass., who instituted the system first at the gray iron plant of his company several years ago and gradually adapted it to meet changing conditions. In fact this flexibility or adaptability is one of the most important features of the system and one that most readily commends it to a group of foundries operating under a wide range of conditions.

In its present form as it has been submitted to the Associated Brass Founders of New England for consideration and ultimate adoption, it is divided into three parts: *Division of accounts, Methods* and *Forms for record and tabulation.* Each of the divisions is itemized and readily may be curtailed or expanded to meet individual conditions.

The first main section, *division of accounts,* brings every item of cost under three main headings, *labor, materials* and *indirect expense.* Each of these is divided and subdivided into as many items as may be necessary to portray conditions accurately and in sufficient detail to enable the foundryman to know his actual costs.

In a typical sheet submitted for adoption, the item *labor* is itemized as *molders, molding machine operators, coremakers* and *casting cleaners.* This classification is sufficient for many foundries, but conceivably it might be extended to differentiate between floor and bench molders, green and dry sand molders, day work and piece work molders. Molding machine operators may be segregated in the same manner according to whether they use hand or power operated machines and other auxiliary equipment. Coremakers fall into a similar classification and in many instances it may be advisable to keep itemized cost figures on the various cleaning operations. Some castings must be cleaned in a certain manner. Others may lend themselves more readily to one method than another. Without comparative figures the foundryman is not in a position to decide which is the most economical. An experienced foundryman can make a shrewd guess, but actual figures constitute an exceedingly convincing argument. Also, actual, tangible figures on a report, remain on record and may be invoked as evidence or reminder at any time. Whether a casting is cleaned by dipping, pickling, tumbling or sandblasting, all the items of time, equipment and labor must be taken into account in reckoning the actual cost of the process as applied to that particular casting or group of castings if they are handled in groups. Labor charge for the men listed in the foregoing classifications is known as direct labor cost and is kept independently from the cost of materials and general supplies which are listed under the second main, division of the system: *Materials.*

Metal Expense Noted

Accurate track of all metal is kept under this heading, *materials.* The form used in a few foundries where only a few standardized products are made will contain a small number of spaces for keeping the record. In the average jobbing foundry the record card must be expanded to receive a wide range of entries. New metal and scrap are classified separately and a separate record is kept of the daily gates and miscellaneous domestic scrap. This particular item is checked monthly to note increase or decrease.

This card also will show the melting loss and bring more closely home to the foundryman the important fact that he does not sell all the metal he charges into the pot or furnace. A certain proportion of the metal disappears enroute and takes with it a certain proportion of the foundryman's profit unless this loss of metal is anticipated and provided for properly in the original estimate. Information on a great many items may

be drawn from the material record by any foundryman who displays an intelligent interest in his various operations. A close study will enable him to develop that intangible but highly valuable sixth sense by which occasionally he may anticipate the market and govern his purchases of raw materials accordingly.

Indirect expense, the third main classification includes more items than either of the other two and was prepared deliberately in this manner to emphasize the importance of this feature. The volume of indirect expense varies to a considerable extent, depending proportionately on the production, but it is present in every foundry although in many instances some of the items are invisible or deliberately ignored. Like any other enemy it is most dangerous while in this position. An open enemy may be fought, but a man has little chance against one that is concealed.

Wages of foremen, clerks and other forms of indirect labor constitute an indirect expense but one that is fairly apparent and that cannot be ignored. Increase or decrease in inventory of castings on hand at cost, may be taken as a fair example of an indirect expense at the other extreme of the list and one that is likely to escape enumeration. This item does not appear at all in many foundries, while in others it assumes important proportions.

Other items of indirect expense are shown in the accompanying table and include maintenance which is subdivided into expenses for machinery, tools, buildings, fixtures, flasks, patterns and auxiliary equipment. Difference between scrap value and cost of casting constitutes an indirect expense on rejected castings. Insurance expense is spread over liability, fire and sprinkler and group. Taxes must be figured, also depreciation on buildings or rent and depreciation on equipment. Freight and express roll up charges that are continued in trucking and teaming. Light, heat and power are in the indirect expense class and must be reckoned into any account that pretends to accuracy. Any other form of account is worthless.

Miscellaneous foundry supplies constitute as indirect expense that may be reckoned on a weekly or monthly

Tabulation of Cost Distribution for Brass Foundries

I—Division of Accounts

Labor

Molders, machine operators, coremakers, cleaning labor.

Materials

New metal	Scrap
copper	copper
tin	tin
lead	lead
zinc	zinc
aluminum	aluminum
etc.	etc.

Increase or decrease in gates, sprues, risers, return scrap.

Indirect Expense

Foremen's wages and wages for other indirect labor.

Maintenance expense for: Buildings, machinery, tools, fixtures, flasks, patterns and equipment.

Rejected castings (Difference between scrap value and cost of casting).

Insurance, liability, fire and sprinkler, group.

Taxes, rent, depreciation on buildings and equipment, freight and express, trucking and teaming, light, heat, power, increase or decrease in inventory of castings on hand (at cost).

Foundry supplies: Sand, coke, gas, oil, facing, chaplets, etc.

Administrative expense: Executive salaries and expense, office salaries and expense, selling salaries and expense, publicity, advertising, legal expense, audit, telephone and telegraph, collections, interest.

II—Methods

1—To figure average pound cost for month, add cost for labor, material and indirect expense, divide this total expense by the number of pounds produced and the result will be the average pound cost.

2—To figure overhead expense, divide the cost of labor by the overhead expense and the result will be the overhead in terms of percentage.

3—To figure the shrinkage in pounds set down first the number of pounds melted plus or minus increase or decrease in sprues and returned scrap. From this amount subtract the number of pounds castings produced, plus or minus casting inventory. The result will show the shrinkage or melting loss in pounds.

To find the loss as a percentage factor divide the first item given, by the second.

4—Cost of melting includes: All labor and metal used, fuel, crucible expense, lining, cleaning and ash removal, depreciation, maintenance, repairs, etc.

Average pound cost of the metal is found by dividing this total by the number of pounds produced plus or minus increase or decrease of inventory costs.

5—To figure average pounds cost per customer, per month, per class of work:

		#1	#2	#3	#4
Add	Labor				
	Material				
	Indirect Expense				
	Total	$	#1	#2	#3	#4
	Total cost	$	$	$	$	#
	Pounds Produced	lbs.	lbs.	lbs.	lbs.	lbs.

Result .....Average pound cost month

III—Forms

Printed cards and other forms on which to tabulate the necessary information include:

Time cards (labor)
Inventory card for metals
Melter's report showing gates, etc.
Factory ledger or expense record
Statement form
Customer's cost form
Recapitulation of (1) Labor (2) pounds delivered

basis and then pro-rated according to the tonnage of castings produced during that period. Only rarely is it possible or necessary to fix the direct charge against any particular casting for the amount of sand, coke, gas, oil, facing, chaplets, etc. used in its preparation.

Whether administrative expense is incurred by one person or by an extensive staff it is a legitimate indirect expense against the operation of the business. Usually it may be itemized under thhe following heads: Executive salaries and expense, office salaries and expense, sales, publicity, advertising, legal expense, auditing, telephone and telegraph, collections and interest.

The second main division of the suggested cost system for brass foundries shows methods for applying the information compiled from the items in the first division. The first method shows how to figure the average pound cost for the month. The second method shows how to figure the overhead expense in percentage· term. How to figure the shrinkage is explained in the third method either in pounds or in percentage. Figuring the cost of the melt is explained in the fourth method. The method of figuring the average pound cost per customer, per month, per class of work is outlined in the fifth example shown.

The first, second third items are simple and involve little work. For example, to figure the average pound cost for a month, the figures for the three items, labor, material and indirect expense are added to secure the total expense for that period. This total expense is divided by the number of pounds produced and the resulting figure represents the average pound cost. This method may be applied to the total output of the foundry, or may be applied to as many subdivisions as may be necessary.

Expense for labor over any given period, say a month, divided by indirect expense for the same period, will give the overhead expense as a percentage of the total cost.

Shrinkage in metal, that is the difference in weight between the metal charged in the furnace and the metal delivered to the customer on any given order may be figured either in actual pounds or in percentage. Shrinkage in pounds is found by subtracting the pounds produced, plus or minus the casting inventory, from the pounds melted, plus or minus increase or decrease in sprues, spills, etc. To find the percentage of shrinkage it is only necessary to divide the item *pounds melted*, etc., by the other item *pounds produced*, etc.

Cost of melting is found by adding together the cost of the following items: All labor connected with melting, new and old metal used, fuel (coke, oil, gas, electric current, coal, etc.) crucibles, lining, cleaning and ash removal, depreciation of equipment, maintenance, repairs, etc. Costs of these various items are totaled and divided by the number of pounds of castings produced plus or minus increase or decrease in inventory costs. The result is the average pound cost for the metal.

Method for figuring the average pound cost per customer, per month, per class of work is shown in item 5 and is the same as the method shown in example 1 with the exception that it is extended to cover the accounts of several customers. This classification sometimes is necessary. The three items *labor*, *material* and *indirect expense* are entered individually against each customer's account. They are totaled at the end of the month for each account and divided by the total pounds produced. The result is the average pound cost per month for each customer's castings.

The third main division of the system deals with forms on which to keep the records. Manifestly the various headings and spacings on these cards and forms will vary according to local conditions. They will include a suitable time card with spaces for date, clock number, pattern number, order number, flasks, hours and any other items considered necessary to meet special conditions. A second card will contain spaces for inventory of metals and a melter's report showing a record of gates and return scrap. A third form serves for a factory ledger or expense record, a statement form, a customer's cost form and a recapitulation of labor and pounds delivered.

Gives Entertainment

The Pittsburgh Foundrymen's association held its thirty-second annual Christmas dinner and entertainment in conjunction with its regular monthly meeting, Dec. 17 in the English room of the Fort Pitt hotel, Pittsburgh.

Inspect Welding Work in Chicago

NUMEROUS demonstrations were made during the annual convention of the International Acetylene association held in Chicago Nov. 14-16. *The accompanying illustration shows a group of officials and guests inspecting a welding job at a Chicago skyscraper. Those shown, reading from left to right, are as follows: J. I. Banash, consulting engineer and president of the American Institute of Safety Engineers; Prof. C. F. Keel, director of the Swiss Acetylene society; Prof. J. D. Hoffman, Purdue university; L. E. Odgen, president of the International Acetylene association; H. L. Whittemore, bureau of standards.*

How and Why in Brass Founding

By Charles Vickers

Obtains Smooth Surface

We have on order a number of bronze die castings in the shape of a heart which must have a clean and smooth surface. We made the first in No. 00 Albany sand but they scabbed. We then tried a No. 2 Albany sand and the castings came out entirely too rough. Can you advise us what grade of sand to use to get a smooth casting that has no scabs on it? We have been told to use Windsor-locks sand for the best results. The castings weigh about 40 pounds each.

The No. 00 Albany sand grade is too fine and *close* for a bronze casting weighing 40 pounds. Even though some founders use it for castings much heavier they are making a mistake which will be discovered on checking up their losses. No. 2 Albany grade is just about right for 40-pound and heavier castings and it will make a smooth surface also provided a facing is used on the pattern. This facing should contain 1 part flour to 25 parts sand, or thereabouts. The most satisfactory way of getting a smooth surface is to use about 3 parts No. 00 to 1 part No. 2, wetted with molasses water and well trodden. Use this facing about one inch thick. Slick the mold, spray with molasses water, dust on flour twice, blowing off each time, then torch the mold surface a nice brown and pour before it gets cool. Outside of the facing the cope and the drag are filled with the No. 2 sand, and it will do no harm to use a thin vent wire thoroughly on the drag. Carefully slick up all openings before spraying the mold surface with molasses water, thus avoiding a run out through the bottom board. By following the above directions and also exercising common sense a fine casting will be obtained.

Alloy Is Fragile

One of our customers uses large amounts of thin castings of aluminum alloy, which must be bent and they complain of the mixture we use that it cracks when drilled and snaps when bent. They are getting the castings elsewhere of an alloy soft and ductile enough to suit all requirements, and we would like to know what this alloy may be, so we can make it.

It probably would cost fifteen dollars to discover just exactly what mixture is being used by your competitors. All that is required is a small sample of the successful alloy, which is sent to any responsible chemist, such as advertise in THE FOUNDRY. In a couple of days the correct analysis of the alloy will be in your possession. From this analysis it will be easy to make the alloy yourselves. We can suggest an alloy that might be suitable, but it will mean more experimentation on your part. The alloy has to be tried out, imposing on the good nature of the customer to that extent. Our suggestion is aluminum 96 per cent; copper 4 per cent.

Lead Causes Difficulty

We are making bushings from a mixture of 65 per cent copper; 32½ per cent lead, and 2½ per cent tin, and are having a great deal of trouble with hard spots and castings full of holes. Can you give us any literature on the proper handling of this kind of a mixture? If not, can you give us any information that will help us to overcome this trouble and enable us to get good solid castings with a uniform hardness throughout? We use about 3 ounces of sulphur in each 150 pounds of metal.

This alloy is a departure from the regular proprietary bronze which consists of 65 per cent copper; 30 per cent lead, and 5 per cent tin, and is a much better alloy than the one given in the query. In this latter the tin has been cut in half, and the lead increased to make up the percentages required for 100 per cent. The makers of the proprietary alloy claim that 5 per cent tin is necessary to make a uniform alloy, and as our own experience has shown them to be correct in this claim, the trouble experienced in making the modified alloy is caused by the change made in the interests of economy. Sulphur has no business in such an alloy as its presence is always a source of trouble of the sort outlined in the query.

Omit the sulphur and then use a flux consisting of plaster of paris, 80 per cent; soda ash, 15 per cent, and borax, 5 per cent. Use about 2 per cent of this mixture, adding half to the cold metals and half after they are molten.

Wants Sound Castings

In making castings of an alloy of 90 per cent copper and 10 per cent tin (new metals) we have had trouble from the metal swelling in the sprue and riser as it cools, the castings being porous. Also in making copper castings, using nothing but copper wire, the same thing occurs in greater degree. Can we avoid this? We also would like to know if the alloy 90 copper and 10 per cent tin fluxed with phosphor copper, is suitable for bronze bushings, and if it can be replaced by a cheaper mixture.

The alloy 90 copper, 10 tin has to be melted carefully to get sound castings, unless a deoxidizer or modifier also is added. Phosphorus added as phosphor copper will be effective when the melting is carried out skillfully. This means covering the metal surface with charcoal for coke-fired crucible furnace melting, using a thin slag of bottle glass in the case of crucible furnaces, oil or gas-fired. This slag should be no more than a quarter inch in thickness for rapid melting furnaces. In all cases the metal in the furnace must be hot, not under 2300 degrees, better a little over that temperature. It can be poured into the molds at any temperature deemed suitable.

For 90 copper and 10 tin mixture, if 89.50 per cent copper is charged with 0.5 per cent manganese copper containing 30 per cent manganese, better results as measured by tensile and other physical properties will be obtained. The melting should be carried out with the precautions given above. For heavy bushings, a better alloy than the 90 and 10 is 85.50 per cent copper; 8 per cent tin; 4 per cent lead, and 2.50 per cent zinc. A little phosphor copper is advisable, about 3 ounces per hundred pounds of the alloy. Some founders omit the zinc from this alloy, but in this case we advise using it. Otherwise it is likely there will be trouble from porosity. Be careful to make all dry sand cores with large vents having a clear exit to the atmosphere. No metal must, on any account be permitted to get into the vents of the cores for bushings. Pure copper castings cannot be made in ordinary brass foundry practice. It is necessary in all cases to deoxidize the copper. Addition of 3 per cent zinc will produce sound castings.

Melting Iron in the Cupola

Part IX

By J. E. Hurst

Receiver Is Useful

MANY advantages connected with the use of receivers or forehearths are outlined in this article by Mr. Hurst. This is followed by a description of the various types, including reservoir ladles, stationary forehearths, tilting types, improved German reservoir and teapot spout ladles. Apart from its use as a reservoir, the receiver collects and stores the metal free from contact with the coke and thus prevents it from picking up carbon by absorption. The receiver also facilitates the addition of any necessary alloys. Merits of a special oil heated receiver designed by the author for use in connection with his centrifugal process are described and illustrated.

VARIOUS mechanical handling and distribution systems have been devised with the object of expediting operation and lightening the manual labor burden involved in transferring molten metal from the cupola to the molds. Factors governing the design of these systems are too remote from the subject to be considered in this work. However, generally speaking, many of these systems are concerned intimately with the rate of metal melting and the manner in which it is stored. A description of the plant adopted for this purpose is highly desirable.

Various special forms of apparatus devised for this purpose are known as receivers, receiver ladles or forehearths. Storage of the molten metal in the standard cupola is effected in the space below the lowest tuyeres or the slag notch and known as the well or hearth of the cupola. Molten metal is collected and stored in contact with the coke forming the bed, and obviously the storage capacity is limited by the coke present and the limiting dimensions of the well itself.

In many foundries, the well of the cupola is too small to supply metal in the most expeditious manner. Where the work varies and the quantity of metal demanded from the cupola from time to time varies within wide limits the collecting capacity of the cupola usually is augmented by a ladle in front of the tapping spout. Large quantities of metal required for the heavier castings can be collected over a period of time without interrupting the casting of smaller items for which metal can be withdrawn as desired from this ladle.

A ladle used in this manner is described as a receiver ladle, and is the elemental form of all the more or less elaborate receivers or forehearths at present in use. Initial purpose of the reservoir is to smooth the difficulties of an irregular demand of molten metal from what might be considered a uniform or uniformly varying source of supply. Many other facilities of use in special cases were found to accompany the use of receivers. As a result many special types of receivers have been designed in

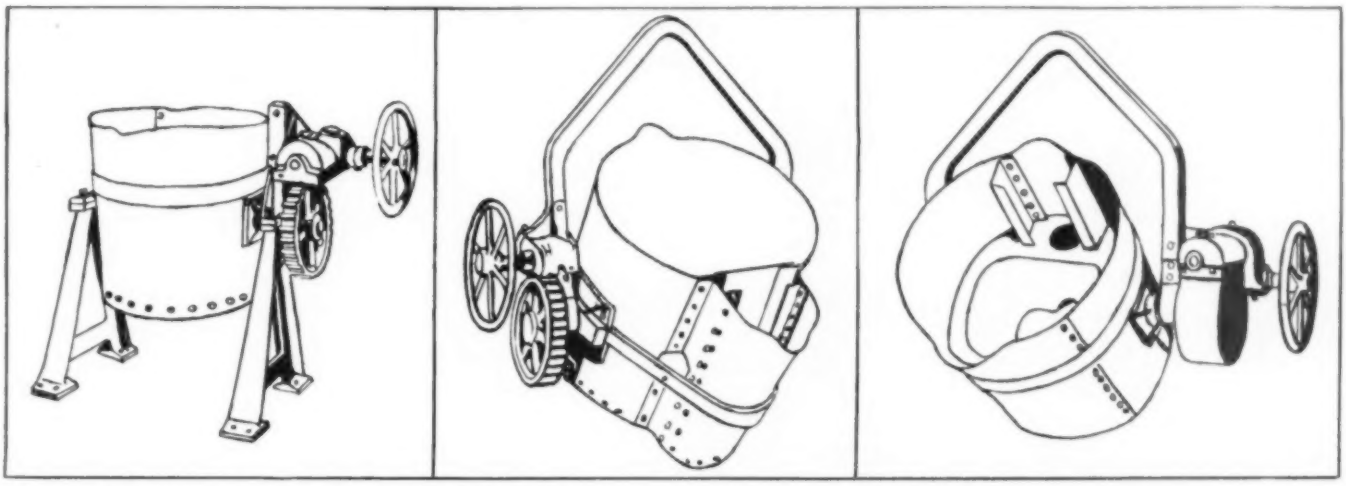


FIG. 60—RESERVOIR LADLE WITH HAND TIPPING GEAR. FIG. 61—TEAPOT SPOUT LADLE WITH SPOUT OUTSIDE. FIG. 62—TEAPOT LADLE WITH SPOUT INSIDE

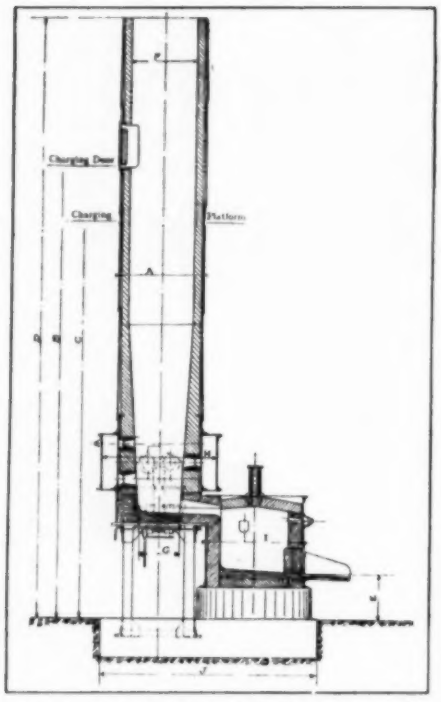


FIG. 63—EARLY TYPE OF RECEIVER BUILT ON A SOLID FOUNDATION

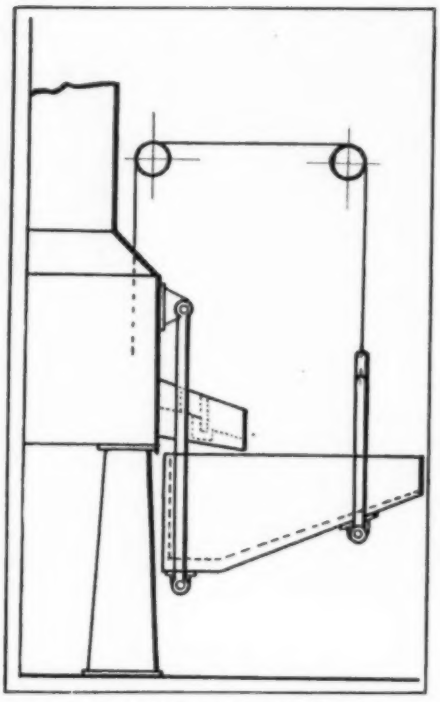


FIG. 64—TILTING TYPE RECEIVER FOR USE WITH THE CUPOLA

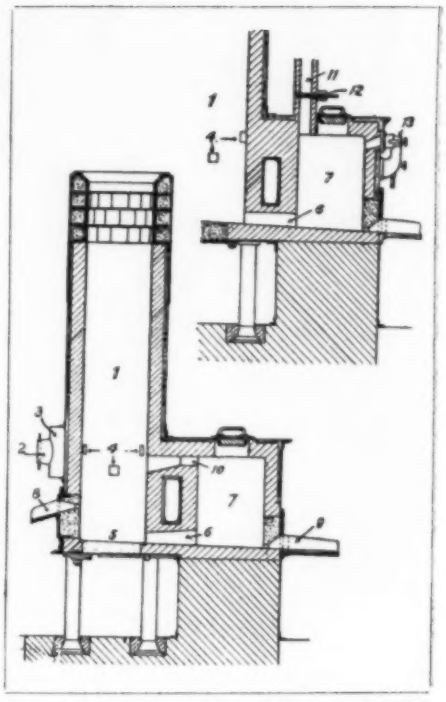


FIG. 65.—A RECEIVER WHICH WAS DESIGNED BY ARDELT IN GERMANY

which one or several of the special facilities have been emphasized.

Apart from its use as a reservoir, the receiver collects and stores the metal free from contact with the coke. This is an important feature where precautions are taken to prevent molten metal from picking up carbon by absorption. With the receiver, the melting practice may be adjusted to collect charges of definite composition before casting, also it facilitates addition of special alloys where necessary or desirable. Obviously features readily may be incorporated for effectively skimming or separating molten metal from the slag, something highly desirable where certain special additions are to be made to the metal. In many receivers these special facilities have occupied a prominent place in determining the features of the design.

The reservoir ladle probably is the simplest form of receiver. A standard type ladle mounted on trunnions and provided with hand or power operated tilting gear. Typical illustrations of reservoir ladles are shown in Figs. 60 and 67. These ladles, in common with other receivers, generally are built in capacity from half to three quarters of the hourly melting capacity of the cupola. They are manufactured in capacities varying from 1000 to 20,000 pounds. The lip or spout of the ladle in the form of a circular orifice clearly illustrated in Fig. 67 serves to some extent to partially skim the metal delivered to the foundry ladle.

Reservoir ladles of the teapot spout type are in use in this country, the continent and America. One of these ladles in elliptical form constructed

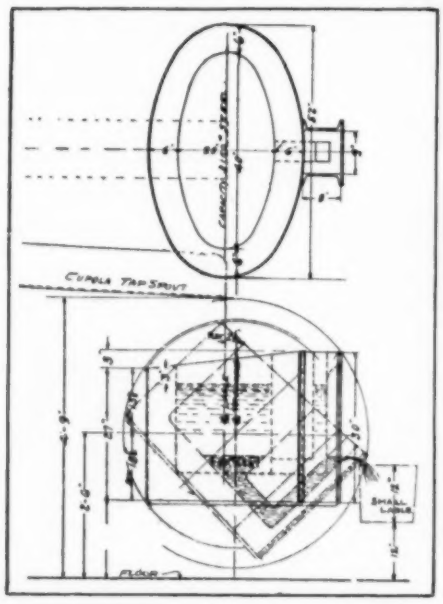


FIG. 66—ELLIPTICAL TYPE RESERVOIR LADLE OF THE TILTING TYPE

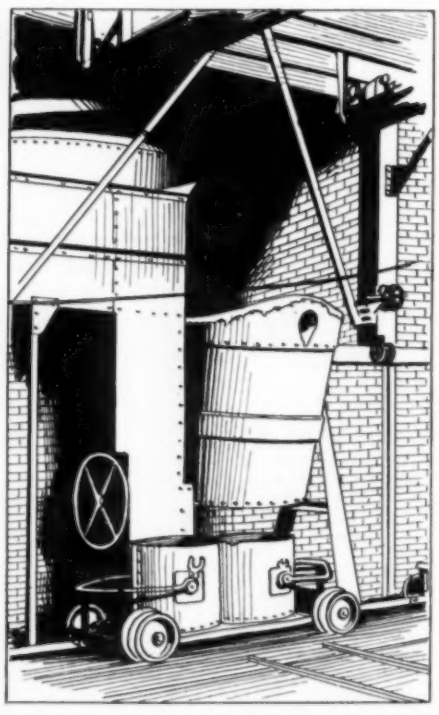


FIG. 67—LARGE RESERVOIR LADLE INSTALLED IN A WHEEL FOUNDRY

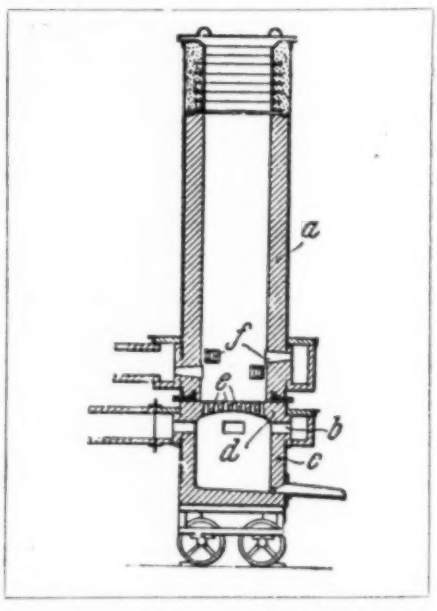


FIG. 68 — ARDELT MODIFICATION OF MATCHELL TYPE RECEIVER

by the Whiting Corp. is illustrated in Fig. 66. It is made in approximately 1½, 3, 5 and 8 tons capacity. Manner in which this type of spout delivers metal free from slag is shown in the illustration. Detail of constructing the teapot spout in ganister is illustrated in Fig. 62.

The early standard type of receiver or forehearth was a circular brick lined chamber erected on a solid foundation and directly connected to the cupola tap hole. A common type in use for many years is shown in the illustration Fig. 63. The receiver is fitted with metal and slag spout. A peep hole is in line with the cupola

A comparatively recent modification incorporating some useful improvements in the design of this type of receiver has been designed by Ardelt in Germany. The receiver is illustrated in Fig. 65.

Prevents Collection of Slag

Bottom of the new receiver—apart from a useful slope toward the tapping hole—is on a level with that of the cupola. The liquid iron passes through an opening from the hearth of the furnace, and into the receiver at the same level. Slag floats on top of the iron in the melting furnace, and, therefore, cannot reach the receiver. A slag-free iron results. As more and more slag is collected in the melting furnace, it is passed off through a slag notch in the usual manner, or is collected by the slag syphon system. Desulphurization can be brought about in the receiver so long as the upper connection between receiver and furnace remains closed. The iron bath in the receiver can be heated by oil, coal dust, gas, coal, coke, or other fuel.

The Ardelt system illustrated in Fig. 65 shows the usual construction of a furnace shaft. At point 2 the air enters the blast belt 3, and out of this through the tuyere 4 into the furnace shaft. The iron falling into the hearth 5 of the furnace passes

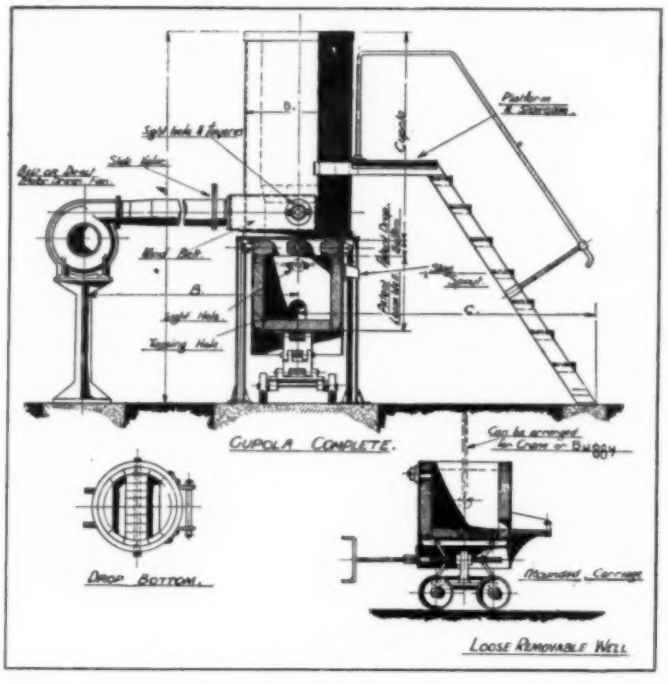


Fig. 69—The receiver is constructed separately and is mounted on a carriage

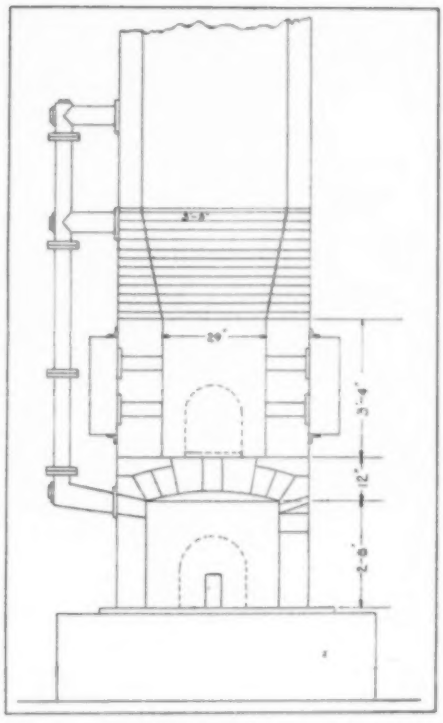


FIG. 70—MATCHELL TYPE CUPOLA AND RECEIVER

connection and a vent pipe is shown in the roof.

The vent pipe formerly was arranged to lead back into the cupola at a point about 3 feet above the level of the tuyeres, and still is extensively used in this manner. It is claimed that the metal is maintained uniformly hot in a receiver of this type totally enclosed, with the hot blast from the cupola circulating over the surface of the molten metal collected therein. Obviously, the loss in temperature which must accompany the use of an open reservoir ladle is avoided. In smaller units, where the receiver is used principally for a reservoir, the totally enclosed receiver of this type is to be preferred. Receivers or forehearths of this type reduce the amount of coke necessary for the bed. The well space below the tuyeres can be reduced to an absolute minimum, sufficient only to allow the construction of the connecting passage to the receiver.

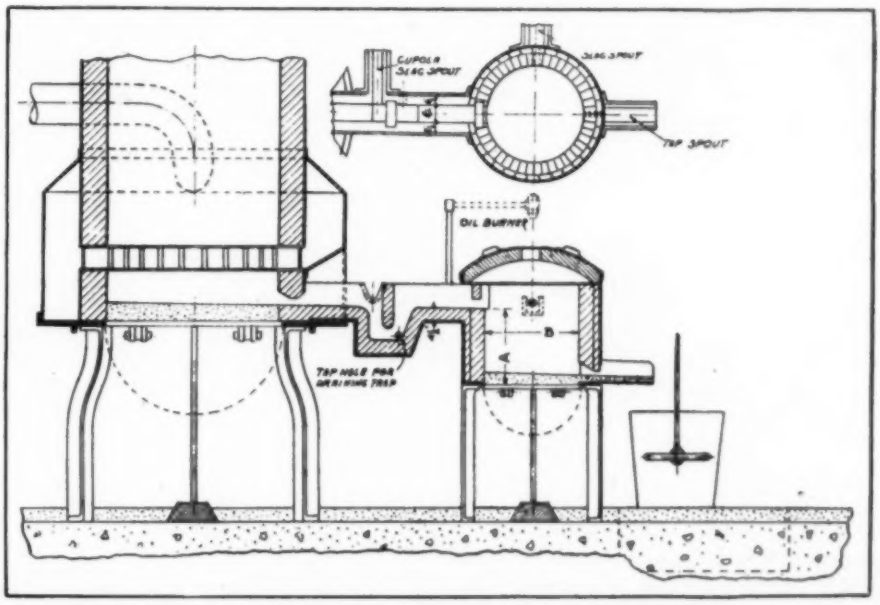


FIG. 71—DIAGRAM OF CUPOLA AND FOREHEARTH MADE BY THE WHITING CORP.

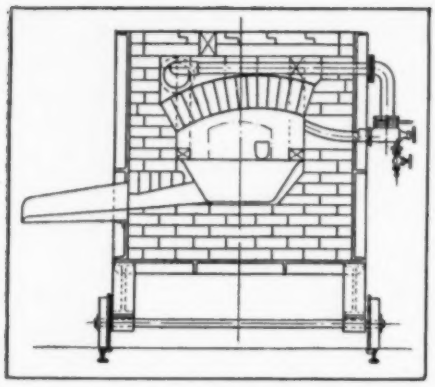


FIG. 72—ANOTHER NONTILTING TYPE RECEIVER

through opening 6 and into receiver 7 at the same level. The slag formed during melting is tapped from the furnace through the slag notch 8, while the liquid iron flows into the receiver. Equal heat between the furnace shaft and the receiver shaft 7 is maintained through an opening at the highest point of the receiver 10. Should the temperature of the iron in the receiver require auxiliary heating, the furnace is constructed without the connecting opening 10. The receiver has a suction pipe 11, which can be closed by a valve 12, and a burner 13 for heating the iron bath by oil, coal dust, gas, coal. This is indicated in the illustration Fig. 65.

This receiver is embodied in the cupola shaft and is formed by building a special brick bridge across the cupola at a point below the tuyere level. This bridge forms the roof of the cavity or receiver, into which the metal flows through the circular hole. The arrangement is shown in Fig. 65. Several cupolas equipped with this type receivers are in successful operation today, both in this country and on the continent.

Ardelt recently has patented an interesting modification of this type cupola and receiver, in which air introduced into the top portion of the receiver penetrates to the coke by way of the holes in the separating brick roof shown in Fig. 68.

A further modification invented by E. Roper & Co., is illustrated in Fig. 69. In this arrangement the receiver is constructed separately from the shaft of the cupola, and is mounted on a wheeled carriage on which it may be withdrawn from the cupola for cleaning and fettling purposes. The division bridge across the cupola is constructed of firebrick in a hinged steel framework, attached to the cupola shaft, thereby insuring all the advantages of a drop bottom. Claims for this arrangement are that it eliminates the bed coke, facilitates fettling operations by dispensing with a sand bottom and a fettling door. The loose receiver with the metal supply can be taken direct to the molds, either on its own bogie, or suspended from the crane. The movable receiver is typical of one used in several other designs, for example, the Klein cupola described in *Stahl und Eisen* 1917. S. 5.

A fore-hearth incorporating a slag removing device and provision for auxiliary oil heating shown in Fig. 71 has been designed by the Whiting Corp. Detail method of construction is illustrated clearly in the drawings and needs no further description.

The Hurst oil fired receiver was designed by the author primarily to meet the special requirements of the centrifugal casting process, to provide metal sufficiently superheated, and to organize metal supplies on lines to meet these special requirements. Construction of the non-tilting type of receiver is illustrated in Figs. 72 and 73.

The oil-fired receiver contains a shallow bath constructed of refractory brick and totally enclosed with a refractory roof. The bath is capable of holding 2 to 3 tons of liquid metal and is provided with a large opening for fettling and constructing the tap-hole, an inspection door, four holes for the oil burners and outlet ports. The outlet ports are arranged to carry the hot waste gases from the hearth chamber into a small chamber above the roof of the furnace, whence they pass into the air.

Heat the Air

Pipes leading air to the oil burners at a pressure of 20 to 25 inches water gage are taken through this roof chamber. During the passage the pressure air becomes heated, thus increasing the economy and efficiency of the burners. Oil is supplied to the burners by gravity feed from a tank supported above the furnace. The oil is elevated to the tank by a small motor-driven rotary pump and is passed through a gauze strainer before it is led to the burners.

The inspection door is arranged to facilitate removal of samples of the metal for test and to permit addition of pig iron or ferroalloys to the bath. The breast is closed by a steel sheet held in position by a hinged spout. The tap-hole is built up with black sand against coke. After the heat the hinged spout is dropped, the steel breast plate removed and the tap-hole destroyed. Slag and fused material can be raked out and the furnace properly fettled.

In actual operation the full complement of burners are used to raise the temperature sufficiently high to receive the molten metal. Starting from dead cold, this takes from 40 to 60 minutes, but with the receiver in regular use this initial heating period is reduced from 20 to 30 minutes. When the receiver is sufficiently hot, the cupola is started and the molten metal is collected in the receiver. The burners then can be closed down gradually. Under regular operating conditions one burner is sufficient to maintain the temperature of the receiver.

With this burner system any adjustment can be made according to the demands of the foundry. During experimental periods as small a quantity as 1000 pounds of molten metal has been held and maintained repeatedly at a perfect casting temperature for periods of 1 to 2 hours. The receiver is mounted on wheels to facilitate repairing. The average oil consumption is from 5 to 8 gallons per hour including oil used in the starting-up period and operating over a total casting period of 6 hours per day. Actual oil consumption per ton obviously depends upon the tonnage of metal handled during this period.

Certain further improvements which have been effected in the design of this receiver are shown in the illustration Fig. 73. The oil burners in this arrangement send the hot flames and gases directly over the surface of the molten metal collected in the hearth of the receiver and on to the stream of molten metal as it issues from the cupola to the receiver. Additional outlet ports lead into the chimney over the connecting passage to the cupola. Concentration of the heat in this passage can be controlled by dampers on the main outlet ports.

(*Concluded on Page* 44)

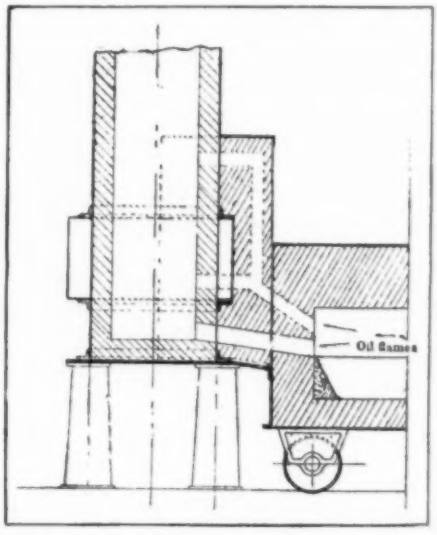


FIG. 73—CONSTRUCTION OF NONTILTING TYPE RECEIVER

The FOUNDRY Family Photograph Album

Upper Left

C. S. KOCH
Fort Pitt Steel Casting Co.,
McKeesport, Pa.

Lower Left

W. J. GREDE
Liberty Foundry Co. Inc.,
Milwaukee

Upper Right

MENTOR WHEAT
Arcade Mfg. Co.,
Freeport, Ill.

Lower Right

R. R. FAUNTLEROY
Moline Malleable Iron Co.,
St. Charles, Ill.

Payment will be made for all contributions on foundry and pattern shop practice suitable for publication

NONFERROUS METAL SPECIFICATIONS

(*Continued from Data Sheet No.* 746)

Specification No. 41, *Yellow Brass*

	Per Cent
Copper	62.00 to 65.00
Lead	2.00 to 4.00
Zinc	31.00 to 36.00
Tin, max.	1.00
Iron, max.	0.50
Aluminum	None
Other Impurities	0.25

General Information: Good castings made of this alloy should give the following minima in physical characteristics:

Ultimate strength, pounds per square inch	25,000
Yield point, pounds per square inch	12,000
Elongation in 2 inches or proportionate gage length, per cent	20

This alloy is intended for use in commercial castings where cheapness and good machining properties are the main considerations.

Specification No. 42, *White Nickel Brass*

	Per Cent
Copper	55.00 to 64.00
Nickel, min.	18.00
Iron, max.	0.35
Aluminum	None
Other Impurities	0.25
Zinc	Remainder

General Information: Good castings made of this alloy should give the following minima in physical characteristics:

Ultimate strength, pounds per square inch	30,000
Elongation in 2 inches or proportionate gage length, per cent	20

This brass is intended for use for trimmings or other parts requiring a metallic-white finish. The higher the nickel content, the more permanent will be the color.

Specification No. 43, *Manganese Bronze*

	Per Cent
Copper	53.00 to 62.00
Zinc	38.00 to 47.00
Lead, max.	0.15

This metal may be hardened by the addition of small amounts of tin, iron, manganese, aluminum or a combination of these metals. Good sand

(*Continued on Data Sheet No.* 748)

NONFERROUS METAL SPECIFICATIONS

(*Continued from Data Sheet No.* 747)

castings made of this alloy should give the following minima in physical characteristics:

Tensile strength, pounds per square inch	60,000
Yield point, pounds per square inch	30,000
Elongation in 2 inches or proportionate gage length, per cent	15

For the purpose of inspection, the most importance should be placed on the following minima in physical requirements on a special chill cast S.A.E. Standard test-bar. This test-bar shall be cut from one corner, near the bottom of the test ingot, cast in a properly tapered iron mold, approximately 2¾ x 3 x 12 inches.

Tensile strength, pounds per square inch	70,000
Elongation in 2 inches, per cent	20

General Information: This alloy is intended for use in castings where strength and toughness are required. It is equivalent to the copper-zinc alloys commercially known as cast manganese bronze or its equivalents, such as cast tobin bronze and cast naval bronze.

Specification No. 44, *Cast Brass To Be Brazed*

	Per Cent
Copper	83.00 to 86.00
Zinc	14.00 to 17.00
Lead, max.	0.50
Iron, max.	0.15

General Information: This brass starts to melt at approximately 1830 degrees Fahr. and is melted entirely at approximately 1870 degrees Fahr. As a brazing material on this brass to be brazed either silver solder or a brazing brass melting at a temperature lower than the brass to be brazed should be used.

Specification No. 45, *Brazing Solder*

	Per Cent
Copper	48.00 to 52.00
Lead, max.	0.50
Iron, max.	0.10
Zinc	Remainder

General Information: This solder starts to melt at approximately 1560 degrees Fahr. and is melted entirely at approximately 1600 degrees Fahr. It may be used by melting it in a crucible under a flux of borax, with or without the addition of boric acid, and dipping the material to be brazed in the melted brazing solder; or this brazing solder, in a powdered form, may be mixed with the flux applied to the material to be brazed, and melted either in a furnace or by the use of a brazing torch.

(*Continued on Data Sheet No.* 749)

Bill Tells of Cupola Fettling Doors

By Pat Dwyer

AT ONE time or another when circumstances have forced you to ask for them, you probably have wondered why some people act so dumb while giving directions to a stranger. Ask half a dozen people in succession where the High Faluting Gimcrack Co., is located and you will be told by the first fellow that he never heard tell of any place or company by that name. He suggests that the Allied Toot & Flute Co., is just around the corner and the Twist Rite Gimlet Co., runs a plant on the next street.

The second lad will give you a dirty look and in a manner you can't mistake, convey the impression that he thinks you are a panhandler. The third merely will shrug one or both shoulders and give you no further attention. The fourth grins in a vacant manner, spreads his hands in a hopeless gesture and remarks "Nix furshstay" or "Me, I no spik Angalish." The fifth relic asks you to repeat the question. He shakes his head regretfully, bums a cigaret and tells you confidentially that this here town is dead. He is sorry he ever blew into it. At the moment he is on the way out, but is a little short. How about comin' acrost with—say—2 bits? No? Well then, a dime? or—Say, listen— The sixth and last lad on this imaginary list says "What do ya think I am? A infomation byuro? Why don't ya ast a cop or look in a darectory or a telephone book or sumpin'?" An experience of that kind imposes a severe test on the nerves and the most placid disposition, but it fades into insignificance beside the reception you are accorded by the cheerfully garrulous type, the willing Willie. One of these walking encyclopedias of miss-information will snap into the breach with right good will. "The High Faluting Gimcrack Co.?" A wide sweeping gesture of the hand and arm indicates the extent of his knowledge. "Sure, I know where it is. You take a High Street car right here. See? Going in this here direction. See? Then you transfer at Center Street and ride to the end, or just about to the end of the line. Don't mention it. Always glad to be of service. Come again some time."

In beautiful and perfect faith and innocence you follow directions to the end of the line where the conductor coldly tells you the place you want is located at the opposite end of the city. Sometimes your willing guide is right. Usually, he simply is drawing on his imagination, or, making the—to him—pardonable mistake of confusing the name of one company with that of another. Right or wrong, you have no redress. You may ride around the town for a week with vindictive thoughts boiling and perfectly killing sarcastic remarks bubbling up in your mind like so many geysers, but you never will see that conductor again.

At this point the reader may be tempted to remark in his careless and offhand way: "Nothing strange about that. All them bimbos look alike when you stick 'em in a uniform."

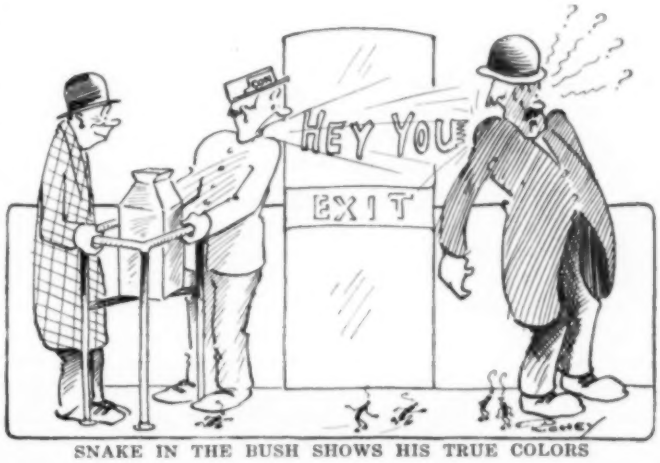
To this sweeping statement I reply, yes and no.

In outward appearance and in certain mannerisms and disagreeable mental traits, they bear a general resemblance to each other in every big city between the east and the west coast and between Hudson Bay and the Gulf of Mexico. The small town conductor is in a different class. Usually he is a friendly, sociable lad, a veritable encyclopedia of local information, willing and ready to answer any question, or to discuss any of the burning issues of the day, local or national.

However, to return to the loose and careless statement that they all look alike. With all due deference, I must beg to differ or in other words file an objection. According to some figures I saw in a paper recently, a force of 1000—perhaps it was 10,000—a cipher one way or another is nothing—conductors are employed in the street car service of this city. Out of that number I probably would fail to identify 998 in the first classification, or 9998 in the second. Either one of the remaining pair I am sure I would recognize even if he was divorced from his shell and disguised with a shave and a haircut and hidden in a suit of civilian clothing. I should recognize—and avoid—him on a bathing beach.

One of these wart hogs caused me to suffer what the legal fraternity is wont to describe as chagrin, humiliation, distress and great mental anguish. I climbed into his car and asked him civilly enough if I was going in the right direction to pass a certain point.

He admitted leisurely and cautiously that we were going out that way. Barring strikes, fires, accidents and other manifestations usually described in contracts and other official documents as *acts of God*, we should pass the point I mentioned in—here he pulled out and consulted a large gold watch and chain— in about 15 minutes. He would not commit himself to a few seconds, y'unerstand, either way; but as nearly as human calculation could figure the problem, he would say approximately 15 minutes. Yes sir, 15 minutes more or less. I was quite



SNAKE IN THE BUSH SHOWS HIS TRUE COLORS

attracted by his seeming friendliness. Here, I said to myself, is a real guy. One of nature's noblemen. A heart of gold and all that kind of thing concealed behind the brass buttons of a uniform. So different to other members of the tribe whose vocabulary is confined to: "C'mon, move up there" "Step lively" and "Hurry up folks, let's go."

I lingered by his station near the fare box for a few minutes exchanging pleasantries touching on the recent election. I was heartened greatly to find that he entertained sound and sterling views on the subject; views coinciding exactly with my own. I was not prepared to endorse fully his wholesale and sweeping denunciation of the opposition, its personnel and its policies, but in the main I agreed with him. He favored the total extermination of those pinhead and prejudiced citizens who held different views to his, but I ventured the opinion that was going too far. I admitted that the spectacle of a few of the more poisonous specimens boiling in oil would afford me great pleasure, but I was no extremist. Live and let live, say I. Moderation should be the watchword.

Fortified with the pleasant glow of satisfaction that accompanies a meeting of this kind with a congenial soul, I forgot to drop a fare in the box before I started on the way to find a seat. Imagine my deep chagrin, humiliation, etc., to hear this snake in the bush, this dog in sheep's clothing call out in a loud voice: "Hey, fella! You with the heliotrope hat! I suppose you thought that talking stunt would get you by? Come back here and pay your fare!"

"Let me out" I cried indignantly. "I do not choose to ride any farther with such a low fellow."

"You and me both, kiddo" he sneered. "This ain't no free excursion. No fare, no ride."

Walking is not listed among my favorite sports and pastimes. No. I would not walk a mile for a carload of 'em, but if that grinning hyena operated the only car in the city and if I was faced with the startling alternative of walking by myself or riding with him, I would walk—or take a taxi. That's the kind of a tough little guy I am.

The second conductor—I'd like to make a lightning conductor out of him—the second conductor who impressed his loathsome personality on me to the extent that I never want to see him again, is one of these self satisfied morons who thinks that a passenger who asks questions, should be in care of a guardian. He is sourly astonished to find that every person is not as familiar as he is with the route he has covered several times a day for years.

Before boarding the car I was told that I should transfer at a certain point. Unfortunately, my informant failed to state whether I should turn to the right or left on the intersecting line. Probably I should have asked him, but one cannot think of everything. The chances are about even

YOUR NOSE KNOWS WHICH WAY THE WIND BLOWS

that he did not know. Anyway, I felt I was safer in taking directions in small doses. No use in attempting to clutter up the old bean with a garbled map of the entire city street car system. One thing at a time and so forth, if you get what I mean.

Also I consoled myself with the reflection that I could get the information fresh and piping hot from the conductor, shortly before we arrived at the transfer point. That's how I got it eventually, fresh and hot—and how! Manifestly I committed a tactical error, but as Ben Franklin or one of his cronies remarked sententiously at one time, we live and learn.

My sense of direction, to put it frankly man to man, is none too keen at the best of times. Boy scouts and other highly gifted and sensitive individuals can find their way by looking at the hands of a watch, by moss on the trees and by wetting the index finger of the right or left hand and holding it—the finger—in a true and vertical position above the head. I tried to remember some of the literature, the rules and regulations I had read on this subject, but dash it all, how was I going to apply the information even if I had it?

I had no watch. So far as my observation went the few scrubby trees we passed were as innocent of moss as the well known rolling stone. I was morally certain that if I was to surreptitiously wet a finger—any finger—and hold it over my head, the conductor would take my action as a signal that I wanted to get off. He would stop the car. Naturally, I shrank from the anticipated, painful ordeal of explaining to him in front of a grinning crowd of passengers, that I simply was endeavoring to ascertain the direction of the wind. My problem was complicated further by the erratic course pursued by the car. Instead of bowling merrily straight ahead, it turned corners, rounded curves, flew off at tangents and zig-zagged like a desperate checker player pushing a lone man across the board. By the time we arrived at a position corresponding to the double corner of a checker board, I did not know whether we were coming or going. Finally I approached the conductor and told him I wanted to get off at Primrose Street. "Suits me" he remarked carelessly. "They ain't nothin' ta stop ya, is they?" "No," I said with just the right tinge of sarcasm. "No, except the trifling fact that I never was here before and therefore will not recognize the street when we come to it." "Ya ain't deef, are ya?" he growled. "Can't ya hear me callin' the names o' the streets as we come to 'em?"

In one way that sounded reasonable, but it presented one serious flaw. It was of no practical assistance. His announcements might just as well have been delivered in high Choctaw. Finally he called a name which by a liberal stretching of the ears and the imagination I translated as Primrose. I approached the ogre again and asked him which car I should take to reach a certain section of the city.

"All cars runnin' north go there," he remarked shortly.

"Say, listen," I said. "I am no mariner's compass. North, south, east and west all look alike to me out here. Can't you be a little more explicit? Shall I turn to the right or left?"

"My gawd," he groaned "some people is dumb. I told ya to go north. What

more do ya want? Some one to take ya by the hand? On yer way before I shut the door."

"Hold this thought," I told him as I hopped off. "I know where you are going and believe you me it is not North!"

When I told Bill of the incident he said I should have landed a good, swift belt on the lad's jaw when he pulled the first funny line. Then I would have had no farther trouble.

"It is just as easy" he continued "to give a civil answer as it is to give one that raises the bristles on the back of the questioner's neck and one that fills him with an enthusiastic desire to lay hands violently on the party of the second part.

"For example, take a typical case. I had an inquiry the other day from a gentleman in Great Britain. In one of the early numbers of a series of articles on the cupola running in THE FOUNDRY he had noted an inserted paragraph to the effect that the fettling door was unknown in American cupolas. He failed to understand how even in America it is possible to make up the bottom of a cupola unless there is some provision equivalent to what is known in British practice as a fettling door. Although the question sounded odd to me I wrote him at some length merely prefacing my remarks with the statement that his astonishment on the American foundryman's failure to employ a fettling door on his cupola is equaled only by the American cupola man's astonishment on why the British foundry cupola operators and builders still cling to this relic of old solid bottom days when a large opening fore and aft facilitated operations after one heat and before another. Necessity for this door departed when the drop bottom type of cupola was introduced. Practically all cupolas employed in American foundries are of the drop bottom type, none of the operators ever saw a fettling door, consequently the door is not found on any of the cupolas. Every cupola equipped with a wind belt or air chamber around the shell is provided with one, two or four doors, depending on the circumference of the cupola. These doors are bolted in place as opposed to the regular riveted construction of the remainder of the windbox. They afford the operator an opportunity occasionally for cleaning slag, coke and metal from the windbox. These doors open only into the windbelt from the outside. With the exception of tuyere openings, a comparatively small opening for the breast and a smaller opening for the slag hole, no other opening extends through the shell and brick lining.

According to universal practice on this side of the ocean, the operator chips and daubs the cupola while the doors hang open and pendent. He stands on a suitable platform, an empty box or barrel, a plank resting on the doors between the hinges or a special step ladder, while applying the daubing material to points beyond his ordinary reach while standing on the floor.

"The bottom doors then are lifted into place and propped with one, two or three upright steel bars. Usually a single prop is considered sufficient support for any size cupola under 60 inches inside the lining. However, two props are adjusted almost as rapidly as one and many careful foundrymen insist on two props under the doors of any cupola over 48 inches inside diameter. Three props are considered advisable under the doors of cupolas 72 inches and over in diameter.

IT'S A POOR WORM DOESN'T KNOW WHICH WAY TO TURN

"Some cupola men prefer to pull up one half door first and then shovel a sufficient quantity of old sand on it to form the bottom before pulling the second half door up into place. The majority of cupola men favor a second method in which both half doors are propped in place immediately after the cupola is daubed. The required amount of old sand is taken up to the charging floor in wheelbarrows or in skid boxes mounted on one of the several types of lift trucks now available for foundry use. The sand is shoveled or dumped directly through the charging door. The number of shovel, bucket, riddle or barrow loads required is determined by trial the first day the cupola is made up for a heat. Thereafter so long as the inside area of the cupola remains unchanged, that amount of sand is dumped through the charging door and allowed to fall in a mound on the bottom doors.

"With the sand in place, the cupola tender throws a rammer down and then follows on a short ladder extending from the bottom to the sill of the charging door. He spreads the sand approximately level with his feet and then rams it firmly with the butt end of the rammer. He imparts a slight fillet to the sand at the ring where it touches the brick lining and with his feet and rammer adjusts the surface of the sand so that it slopes downward from the back of the cupola toward the tap hole. An experienced man can do this readily, but the beginner, or the man substituting for the day should check the slope with a level. A smooth, uniform surface on the sand may be secured by rubbing it with a wood block, a short straightedge or with a molder's trowel. However, this extra refinment only is practised when the cupola man is not pushed for time. It is not necessary and only is done for the same reason that impels some molders to blackwash and slick every mold irrespective of whether it is for a sewer ring or an engine frame for a millionaire's pet yacht. The instinct for neatness is their ruling weakness and every other consideration is subordinated to it. Neatness is a commendable virtue, but like many other virtues it can be pushed to a point where it becomes a nuisance and a liability.

"After the man has completed the bottom he climbs out through the charging door and removes the ladder through the same opening. In some instances before he climbs out he holds a board against the inside while his assistant packs material to form the breast. In other instances the breast is left open until after the fire has been lighted. In any event practically all the work is done from the inside of the cupola, therefore there is no need of a fettling door through which the operator can do part of his work from the outside. On a cupola too small for a man to work on the inside, the necessary work could be accomplished through the breast opening, but outside of tilting experimental cupolas, I know of none that size in this country.

Use Sweeps on Tapered Pulley

Savings in Pattern Cost in the Production of Circular Castings May Be Effected Where Spindle, Sweeps and Other Equipment Are Available

By J. H. Eastham

HEAVY-DUTY, tapered, cast-iron pulleys typified by the example shown in Fig. 1 enter to a considerable extent in to the equipment of modern pulp and paper mills. A complete pattern for one of these castings constitutes a heavy charge against the job. This charge may be overcome if the shop is equipped with a spindle and auxiliary equipment of the type usually employed where castings are made in loam molds or where sweep work is practiced to a greater or lesser extent in making sand molds.

To make one of these tapered pulleys according to the method shown in the accompanying illustrations, a cinder bed is put down slightly greater in extent than the area enclosed in the casting and about 2 feet below the floor level. A vent pipe is placed with one end resting on the coke and the other end projecting above the floor at a point opposite to that at which the pouring basin will be located later. The spindle socket is adjusted level either on the coke, on a bed of sand, on wood blocks, or it may be set in place on the bottom of the excavation before the coke is shoveled into place. The only really essential feature is that it must be set rigidly to support the spindle perfectly plumb. With the spindle in place the remainder of the space in the pit is filled with sand which then is rammed flush with the foundry floor.

Uses Plain Sweep

A level sand bed is swept by attaching a plain, straight sweep to the spindle arm. This surface forms the first parting plane. The arm then is raised to a suitable height and the plain sweep replaced by a strickle on which the inner face corresponds to the full depth and outside diameter and shape of the proposed casting. Proper allowance is made for contraction and machine finish. A brick core is built as in ordinary loam practice, covered with rough mud and swept to shape. After the mud has stiffened it is covered with paper or wet parting sand, slicked to form a smooth surface.

A single deep flask or a number of shallow flask sections are placed around this temporary core which in this instance represents a pattern. If necessary a special parting may be formed at the bottom, or, upsets may be placed between the flask rings to bring the top of the upper flange in line with the top of the brick and loam pattern. The object of this is to insure a level surface on which the face of the cope may rest. The cope is rammed independently on a plate, a board or a level bed on the floor.

Form the Cheek

Space between the flask sections and the brick core is rammed full of sand in the usual manner. A row of gaggers is placed around the bottom to reinforce the sand in that vicinity. The thickness of the vertical sand wall will vary, depending on the available equipment. Usually one flask may be employed for making pulleys of several sizes. Thus in one instance the thickness of sand at the bottom may not exceed 3 inches, in another the thickness may be 10 inches. Unless the flask is provided with a generous sand strip at the lower inside edge, a crab or plate will be required to support a wide or thick sand wall. The outside wall of the mold ready for removal from the core is shown in Fig. 3.

Where a single flask section, or the only available combination of flask sections, is too deep, a depressed parting is formed around the lower edge as shown in Fig. 4 where a small board beveled along one edge is screwed temporarily to the lower extremity of the main sweep.

Suitable guide stakes are driven into the sand close to the flask before it is lifted away. Some molders prefer to cut one or more side risers at the top edge, while other men choose to carry the risers straight up from the edge. Practically their only purpose is to announce when the mold is filled with metal. The cheek is placed on suitable supports where the inside may be finished, slicked and covered with a coating of plumbago, rubbed in by hand. Under certain conditions it may be advisable to cover the surface with wet blacking and then skin dry that part of the mold.

After the brick and loam pattern has served its purpose it is removed and a proper sand core is erected in its place. The upper and lower parts of the core are formed from green sand, but the center part containing the arms is formed with a set of dry sand cores. The arms cores touch in the center where the inner extremities rest upon a round core designed to form the lower part of the hub. A similar core forms the upper part of the hub. Space between the arm cores as they radiate from the center is filled with green sand. A short strike *A*, Fig. 5, fastened to the vertical board forms the seat for the arm cores.

In some instances a strike is employed to form the seat for the hub core, but usually it can be slipped down over the spindle and tucked accurately into place after the seat has been formed for the arms.

Where the lower part of the green sand core is wide and shallow, no reinforcement is required. but where this body is high and the dry sand cores are heavy it is advisable to drive a ring of bars or stakes as shown in the illustration. The upper part of the green sand core is reinforced with a row of rods set horizontally near the top as shown at *C*, Fig. 5.

Core Serves As a Guide

The lower half of the hub core serves as a guide in locating the inner ends of the arm cores. The outer ends are spaced with a pair of trammels and if necessary are adjusted to a trifling extent so that the vertical sweep just touches them. The upper part of the hub core and the center core cannot be placed until after the removal of the spindle. Usually a small ring pattern of some kind is placed around the spindle to preserve an opening while ramming and sweeping the upper part of the green sand core. The upper arm of the sweep forms the upper face of the core as shown at *B*, Fig. 5. After the sweep and spindle have been removed, the center core is placed in its print and covered with the upper half of the hub core. Suitable gate sticks are placed in openings provided for the purpose. The small ring pattern is removed and the space occupied by the patters is filled with rammed sand.

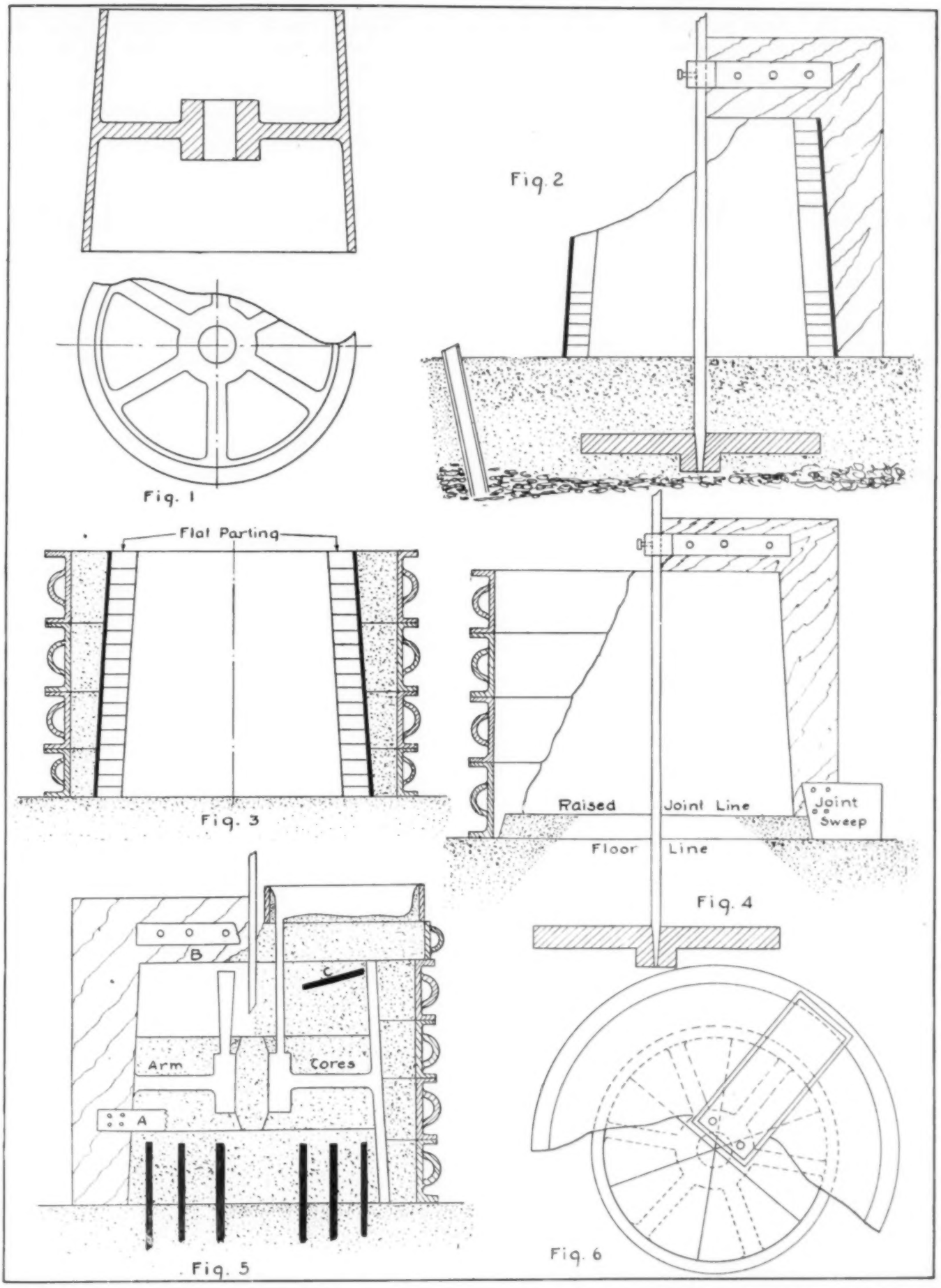


FIG. 1—HEAVY DUTY TAPERED CAST IRON PULLEY. FIG. 2—EQUIPMENT FOR BUILDING BRICK AND MUD TEMPORARY PATTERN. FIG. 3—OUTSIDE PART OF MOLD FORMED IN SAND. FIG. 4—DETAIL OF FORMING SPECIAL PARTING AT BOTTOM. FIG. 5—COMPOSITE SKETCH SHOWING CONSTRUCTION AND SECTIONAL VIEW OF FINISHED MOLD. FIG. 6—PLAN VIEW OF COMPLETED MOLD

The face of the core then is finished and blacked after which the cheek is returned to place, followed by the flat cope or a ring of cake cores. An opening is left in the center of the cope for a pair of long gate pins. With these in place the space is rammed full of sand and the runner box is made. On small pulleys a drag usually is employed instead of the floor as described. The various parts of the mold then may be clamped together. In the method described, the mold must be weighted. The weights should not rest directly on the cope, but should be supported independently about an inch above the cope. Wedges inserted between the weights and the cope will hold the parts of the mold together.

Analysis of a suitable iron mixture follows: Silicon 1.80 per cent, sulphur 0.10 per cent, phosphorus 0.40 per cent, manganese 0.80 per cent.

Government Gives Malleable Data

ACCORDING to data collected and presented in the 1928 biennial census of manufacturers by the department of commerce, commercial foundries produced in 1927, 585,-616 tons of malleable iron castings for sale as such, valued at $81,064,-855, representing a decrease of 17.8 per cent in tonnage and 20 per cent in value as compared with 712,499 short tons valued at $101,348,758 produced in 1925. The average price per ton also decreased from $142,25 to $138,43 a loss of 2.7 per cent. Out of the 10 states listed, only Pennsylvania, Connecticut and California showed increases in tonnage.

Illinois, New York, New Jersey, and California showed a substantial gain in price but in the remainder of the states the price decreased, notably in Michigan. In that state both the tonnage and the price has decreased. Here, the price dropped from $132.66 to $116.52, a loss of $16.06 per ton. This probably is due to the attitude of the automobile manufacturers toward buying castings outside their own shops. Many of the decreases in price can be explained by the fact that foundries are installing more modern equipment and thus are able to produce castings at a lower cost. Under the heading "All Other States" so headed to avoid disclosing the production of individual foundries, the production fell off but the price secured for the product increased.

Manufacturers in New Jersey receivced the highest average price for their castings, $132.72, while in Michigan the price was lowest, $116,52. New Jersey gained the most in price over the preceding census year, $16.06, and in Pennsylvania the price decreased the most, $28.01. These prices depend on the class of castings produced and have a direct bearing on the prices in different localities. Local conditions and costs of materials also influence the prices. According to tonnage those state leading the list are as follows for 1927: Michigan, Ohio, Illinois, Wisconsin, New York, Indiana, Pennsylvania, Connecticut, New Jersey, and California; according to price per ton of castings they rate as follows: New Jersey, Connecticut, California, Pennsylvania, New York, Ohio, Illinois, Indiana, Wisconsin and Michigan. From these listings it can be seen that those states producing the largest tonnage received the lower price while those whose tonnages was small received the higher prices. This may be due either to competition or to better manufacturing facilities in those states where the tonnage is large.

Distributes Catalog

The Surface Combustion Co. Toledo, O., recently has issued a catalog of data on industrial heating processes. It is a cloth bound, loose-leaf volume. The book is divided into sections on combustion data, engineering data, burner equipment standard small furnaces, large furnaces and auxiliary equipment. The section on combustion data is composed of tables and graphs of various constants and properties of metals and gases. The principles of surface combustion and the operating principles of gas burning systems are explained.

The section on engineering data gives tables of conversion factors, flow of gases, air velocities, pipe dimensions and many other tables and graphs containing valuable information. The burner equipment division explains the working of several types of burners and gives much data on regulation, installation, manipulation, etc. Sections 5 and 6 describe and explain various types of large and small furnaces for many uses. The division on large furnaces gives illustrations from photographs of typical installations, tells where these are located and gives a list of those of the certain type being discussed which have been installed by the company. Their advantages are listed as are the fuel used and operating data. The last section is the index which lists the contents alphabetically. The book as a whole contains much valuable information to the combustion engineer and to the executive who is contemplating the addition of furnaces to his plant.

Statistics on Malleable Castings Manufactured for Sale

ACCORDING TO U. S. CENSUS OF MANUFACTURES

	1923			1925			1927		
	Net Tons	Price Per Ton	Sales Value	Net Tons	Price Per Ton	Sales Value	Net Tons	Price Per Ton	Sales Value
Ohio	141,351	$161.21	$ 22,787,732	115,257	$141.25	$ 16,279,900	80,932	$136.20	$11,020,268
Illinois	126,594	153.20	19,394,642	130,347	128.88	16,799,669	79,165	130.86	10,359,792
Michigan	115,532	164.26	18,977,293	122,461	132.66	16,232,457	121,972	116.52	14,211,523
Wisconsin	97,285	142.36	13,849,458	91,132	124.89	11,378,065	77,178	121.38	9,378,027
New York	93,400	163.09	15,232,718	75,779	144.67	10,963,200	63,142	155.28	9,804,938
Pennsylvania	69,214	163.45	11,312,664	40,970	198.51	8,132,873	41,029	170.50	6,995,557
Connecticut	18,371	230.13	4,227,652	15,021	237.27	3,563,991	15,532	215.13	3,351,351
New Jersey	8,277	204.68	1,693,945	8,609	220.16	1,895,317	7,973	232.72	1,855,539
Indiana	7,267	145.17	1,154,924	67,878	136.22	9,246,059	62,943	130.70	8,266,410
California	5,115	168.50	861,884	5,209	199.96	1,041,614	5,926	174.44	1,033,742
All Other States	39,163	183.35	7,180,669	39,836	145.99	5,815,613	29,824	160.60	4,787,708
Total	721,569	161.69	116,673,581	712,499	142.25	101,348,758	585,616	138.43	81,064,855

WHAT OTHERS ARE THINKING

Abstracts Selected from the World's Foundry Literature

Describes Influence on Growth

Der Einfluss von Kohlenstoff, Mangan und Silzium auf das Wachsen des Gusseisens, by O. Bauer and K. Sipp, *Die Giesserei*, Duesseldorf, Oct 12 and 19, 1928.

Bauer and Sipp carried out a number of investigations to determine the effect of carbon, manganese and silicon on the growth of cast iron and came to the following conclusions: That growth at temperatures below the pearlite point (700 degrees Cent.) is based primarily upon the breaking up of cementite contained in the pearlite; at temperatures above 700 degrees Cent. it is due to the separation of carbon from the solid solution. Theoretically each iron-carbon alloy strives for a stable end condition (ferrite-graphite). Next the temperature and time duration of the heating period play a measurable role. The higher the temperature, the shorter is the requisite time. The lower the temperature, the longer the time duration to reach the end of the process.

At ordinary temperatures (about 20 degrees Cent.) cast iron apparently is stable as the time factor plays so great a role that changes cannot be perceived. A valid time-temperature curve for all kinds of cast iron for higher temperatures at which the primary process of the breaking up of carbide and the separation of carbon proceeds comparatively rapidly, is impossible, as the chemical composition as well as the structural formation through composition and solidification factors play an important part.

Silicon favors growth to a high degree. Manganese has an effect strongly opposite to silicon. Carbon appears to reinforce the effect of silicon when high silicon and low manganese are present. However, with high manganese content the carbon does not exert a noticeable effect even with high silicon content. If the matrix consists principally of pearlite, at most a balling together of the pearlite occurs at temperatures below the pearlite point; it becomes granular and only then the destruction of the carbide sets in according to results obtained.

If free ferrite already exists, the freed ferrite resulting from the disintegration of carbide joins that already existing while the separated carbon migrates to the existing graphite leaves, making them thicker and more voluminous. Accordingly ferrite and graphite act as germs. Formation of new graphite leaves or round separations of temper carbon such as those observed in annealing white cast iron cannot be controlled. Annealing above the pearlite point (above 700 degrees Cent.) the matrix structure is altered completely; pearlite goes into the solid solution (austenite); arrangement of the graphite network remains the same. However, the carbon separated from the solid solution in this case joins the existing graphite without forming new graphite or temper carbon inclusions.

Density of the casting is of considerable importance. Growth occurs first in the place of least resistance; consequently in the external surface of the test piece. If the core structure is lacking in density, the process sets in simultaneously in the core which leads to peculiar zone formations and quick growth within the casting. The conditional volume increase through this primary growth, as was mentioned previously, is not very material. However, it represents an important breaking down of the structure and thereby opens the way for secondary growth through outside corrosive and oxidizing influences.

Investigates Effect of Heat

Heat Treatment and Volume Changes of Gray Cast Irons between 15 degrees and 600 degrees Cent., by J. W. Donaldson, *Foundry Trade Journal*, London, Oct. 25, and Nov. 1, 1928.

This article is from a paper presented at the annual meeting of the French Foundry association in behalf of the Institute of British Foundrymen. The author divides his work into two parts. The first relates the influence of heat treatment on decomposition of combined carbon, strength and hardness, and the second deals with volume changes between 15 and 600 degrees Cent. Donaldson used cast irons in which only one element was allowed to vary at a time. In the carbon series the total carbon varied from 2.71 per cent to 3.51 per cent. In the specimens with variable manganese content, the manganese content ranged from 0.52 per cent to 2.43 per cent. The phosphorus series varied in content from 0.20 per cent to 1.06 per cent. Each of these groups contained four types. The silicon series was much larger and contained 10 types with silicon varying from 0.65 per cent to 2.19 per cent.

Donaldson concluded from his tests on the influence of heat treatment on decomposition of combined carbon, strength and hardness, that temperatures below the critical range produce changes which affect the strength and hardness. These changes are due to decomposition of the combined carbon and are influenced by the temperature and duration of the treatment and the composition of the iron. Duration of treatment affects the amount of change and for the various temperatures and different irons, equilibrium values are attained for the 200 hours' period of heating. Increase of total carbon from 2.71 to 3.51 per cent decreases stability and heat resisting qualities, a decided change occurring between 2.71 and 3.08 per cent. Increase of manganese between 0.52 and 2.43 per cent produces a uniform increase in heat resisting qualities. Phosphorus increase from 0.20 to 1.06 per cent produces slight but uniform increase of heat resisting properties. Silicon produces a marked influence on heat resisting properties. With less than 1.10 per cent silicon great stability is attained which increases uniformly as the silicon decreases to 0.65 per cent. Over 1.17 per cent silicon decomposition of combined carbon is considerable and increases as silicon increases. There appears to be a critical composition of silicon between 1.10 and 1.17 per cent, so far as combined carbon decomposition is concerned.

In determining volume changes between 15 and 600 degrees Cent. Donaldson used the same series of irons except that he omitted some of the silicon series. These contained 1.03, 1.10 and 1.17 per cent respectively, and were the third, fourth and fifth of the series. His conclusions are that when gray cast irons are subjected to repeated heatings and coolings below their critical ranges, they invariably show volume changes of varying magnitudes. Increase in volume following the first few heatings is due to the decomposition of the combined carbon, provided that decomposition is accompanied by an increase in the size of the graphite flakes. Where decomposition has taken place with increase in the size of the graphite flakes, air penetrates along these flakes and causes oxidation of the iron in the vicinity of the flakes, which oxide gradually replaces the graphite, and this oxidation causes further volume changes which in some irons attain a maximum after a certain number of heatings. Extent of growth is dependent on dimensions and form of the graphite after decomposition of combined carbon, and on the relative amount of oxidation; factors which are controlled by the iron composition. Low total carbon content with little graphite and in finely divided condition tends to small volume change and vice versa.

Increase in manganese content causes slight increase in growth due to manganese of decomposed manganese carbide oxidizing readily. Increase in phosphorus hinders volume changes as the phosphide eutectic decomposes slower than the pearlite eutectoid. Irons containing up to 1.1 per cent silicon show little growth while irons containing from 1.2 to 1.5 per cent silicon show a fair volume increase accompanied by oxidation of the ferrite which increases to attain a maximum after approximately 100 hours' heating at 550 degrees Cent. Higher percentages of silicon, 1.5 to 2.2 per cent, produce marked growth due to oxidation of the silicon and iron which continues after 200 hours' heating; the extent and rate of growth depending on the silicon content.

The Shakeout

DAN M. AVEY, Editor

PAT DWYER, Engineering Editor
FRANK G. STEINEBACH, Associate Editor
CHARLES VICKERS, Nonferrous Editor
EDWIN BREMER, Associate Editor

¶Appraising Men

THE employment or discharge of workmen is a problem that requires the foreman to use extremely good judgment. Upon his decision rests the progress of the company. He must render a decision that will benefit his employers to the greatest extent, for his ability to secure the proper class of workers and increase the efficiency of the plant through this medium, often represents the margin of profit. Each case that confronts the foreman is an indivdual one and it is here that the foreman must justify his employer's faith in him. A foremanship once was held to be the reward of long and faithful service, but times have changed and it is the man who is unbiased, judicious, immune to favoritism and favor currying and is thoroughly schooled in all the phases of his work that is promoted to this important stewardship.

THERE has been a gradual broadening of viewpoint with regard to employment. Many industries have discarded the old methods and have reached the conclusion that it is the work of individuals that is responsible for the success or failure of an enterprise. One large concern has established six definite rules of conduct for all employes regardless of the nature of their work. These rules apply equally to the general manager and the laborer. They have been tested for a considerable period and a careful check has been made of the effect of their observance both on the job and in outside relationships. It has been observed that men who follow these rules become more efficient on their jobs. They also succeed better in their personal affairs and their home life is happier.

The six rules this company has established are:

1. Follow instructions willingly.
2. Be clean and orderly.
3. Take good care of property and materials.
4. Work well from whistle to whistle.
5. Work every day you can and tell your foreman when you cannot.
6. Work well with others.

Soon after this program was inaugurated it was necessary to lay off some of the employes in each department. Printed forms were given each foreman on which to record the observance of the six laws by the individuals. At the top of the card were places for the date, name, department, and job of the employe. Following these were the six rules with two spaces opposite each for the foreman's *yes* or *no* according to the employe's conduct in observing the rules. The day of the layoff the foremen were called into the office in groups and the forms carefully explained. Each foreman was given to understand that men would be retained in accordance with his report of the men's observance of the rules and that it was the company's purpose to avoid laying off any man who had maintained a good record during his employment.

When the reports had been turned in, each foreman was called into the office to explain why certain men had received poor records. Many of them asked to be allowed to revise their records and in this way favoritism was practically abolished. Even with all these considerations some of the men with good records had to be layed off. This was taken care of under rule six and the employment department secured jobs for all the deserving employes. When work increased, these men were re-employed in accordance with their records.

ANOTHER large foundry company has established a similar system in its organization but has added several more rules to the six that the first company used. As in the previous case, this method of increasing the efficiency of its workers has paid dividends. By weeding out the undesirables, these companies have found that they made records in maintenance of equipment; have conserved large amounts of material; their scrap is low; the plants are clean, and accident records are extremely low.

Such a program not only is a benefit to the employer by reason of increased profits, but also is a source of pleasure to the employe because of his increased opportunity. It is well to remember that

Efficiency Is the Margin of Profit

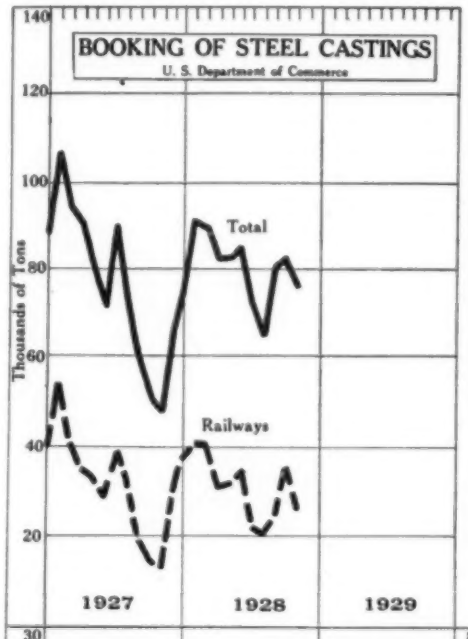
Trade Trends in Tabloid

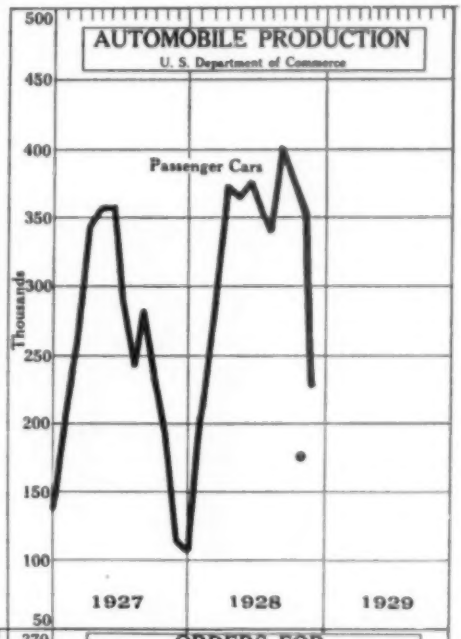
PROSPECTS for exceptionally satisfactory business in the foundry industry are bright as the new year opens.. Numerous factors indicate that in some lines the demand for castings will be greater than in the year just closed. Leaders in the automobile industry believe that a new high record for production will be established in 1929. Automobile shows to be held in New York and other centers this month should lead to greater production schedules shortly. The last few weeks in 1928 witnessed some stimulation in the buying of equipment by the railroads, and the outlook for the coming year probably is the brightest in half a decade. Although building awards in November declined slightly over the total for October, the volume of new construction still is high and a large amount of work is expected to be started in the near future. Pig iron shipments are above normal in several sections of the country and practically all important foundries are covered for the first quarter, if not for the first half. In the midwest, the malleable industry is reported in a healthy condition. While gray iron jobbing foundries have experienced a customary slackening in demand during the past few weeks, the slowing up has not been as pronounced as in some recent years. Prospects for a much greater demand for castings in that field this year are reported to be excellent.

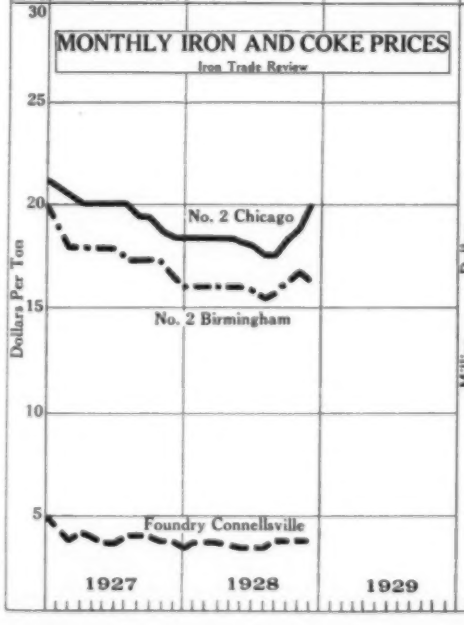
RAW MATERIAL PRICES

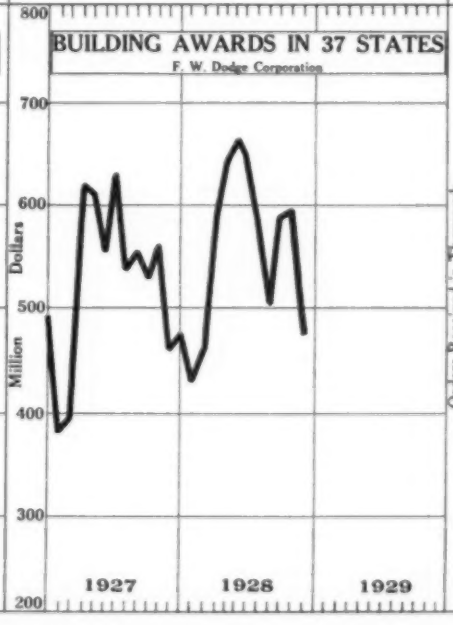
Dec. 6, 1928

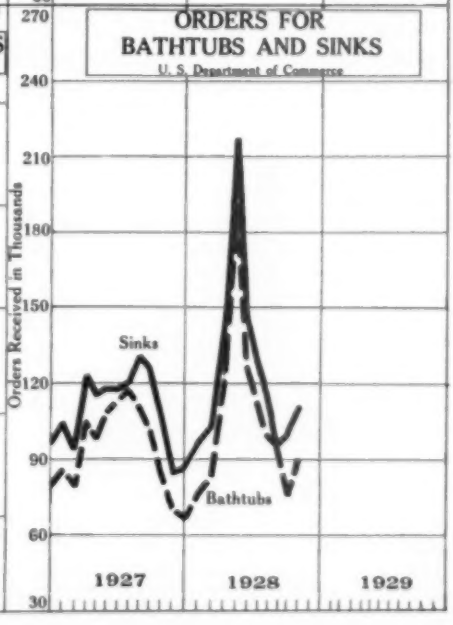
Iron	
No. 2 foundry, Valley	$18.00
No. 2 southern, Birmingham	16.50 to 17.00
No. 2 foundry, Chicago	20.00
No. 2 foundry, Philadelphia	21.26 to 21.76
No. 2 foundry, Buffalo	18.50
Basic, Valley	17.50 to 18.00
Basic, Buffalo	17.50
Malleable, Chicago	20.00
Malleable, Buffalo	19.00
Coke	
Connellsville foundry coke	$3.75 to 4.85
Wise county foundry coke	4.50 to 5.25
Scrap	
Heavy melting steel, Valley	$16.75 to 17.00
Heavy melting steel, Pitts.	17.50 to 18.00
Heavy melting steel, Chicago	14.50 to 15.00
Stove plate, Buffalo	14.00 to 14.50
Stove plate, Chicago	12.25 to 12.75
No. 1 cast, New York	13.00 to 13.50
No. 1 cast, Chicago	15.75 to 16.25
No. 1 cast, Philadelphia	16.50 to 17.00
No. 1 cast, Pittsburgh	14.50 to 15.00
No. 1, cast, Birmingham	14.50 to 15.00
Car wheels, iron, Pittsburgh	15.50 to 16.00
Car wheels, iron, Chicago	14.00 to 14.50
Railroad malleable, Chicago	17.00 to 17.50
Agricultural mal., Chicago	13.00 to 13.50
Malleable, Buffalo	15.50 to 16.00
Railroad malleable, Pitts.	14.00 to 14.25
Nonferrous Metals	Cents per pound
Casting, copper, refinery	15.75
Electro, copper, producers	16.00
Straits tin	49.50
Lead, New York	6.50
Antimony, New York	9.75 to 9.87½
Nickel, electro	37.00
Aluminum, No. 12, producers	23.00
Aluminum, No. 12, remelt	16.50 to 17.00
Zinc, East St. Louis, Ill.	6.35











Comings and Goings of Foundrymen

Men of the Industry, Whose Activities Are Making Foundry History

WILLIAM W. SWAYZE, formerly manager of the American Manganese Steel Co., New Castle, Del., plant recently has been made superintendent of the Deemer Steel Casting Co., New Castle, Del. Mr. Swayze was affiliated with the Taylor-Wharton Iron & Steel Co., High Bridge, N. J., prior to his employment at the American Manganese Steel Co.

R. P. Lamont, president, American Steel Foundries, 410 North Michigan avenue, Chicago, recently has been made vice president of the Northern Central division of the chamber of commerce of the United States.

Ira A. Wyant, secretary-treasurer of the Campbell, Wyant & Cannon Foundry Co., Muskegon, Mich., was recently elected vice president of the West Michigan Consumers Co., to succeed H. D. Eliason, who has resigned from the firm.

J. F. Gaffney, for four years foundry and pattern shop manager for the Toledo Machine & Tool Co., Toledo, O., has resigned. He has announced no new connection and is at present located at 2723 Monroe street, Toledo.

F. G. Bennett, Buckeye Steel Castings Co., Columbus, O., has been appointed chairman of a committee to study the accident problem in foundries by the metals section of the National Safety council. The cause of accidents in foundries will be studied and a report will be presented at the next meeting of the council. The co-operation of all foundry members is asked.

Arthur J. Tuscany, manager, Gray Iron institute, Terminal Tower building, Cleveland, O., recently was presented with a handsome marble and gold desk set by the Ohio Foundries Association Inc. Mr. Tuscany for seven years previous to his present connection was secretary-manager of the Ohio group. The presentation was made by C. C. Smith, Toledo Steel Casting Co., Toledo, O., president of the association.

H. M. Reed was elected first vice president and chairman of the executive committee, at a special meeting recently of directors of the Standard Sanitary Mfg. Co., Pittsburgh. R. E. Sargent was made vice president and sales manager; and T. E. Muller was elected vice president and general manager of factories. Mr. Sargent and F. F. Kaulbach were elected directors to take the places of J. W. Oliver and W. C. Chamberlain.

S. S. Eagle, general manager, American Car & Foundry Co., Madison, Ill., has been nominated for a directorship of the Illinois Manufacturer's association.

WILLIAM W. SWAYZE

E. B. Gilmour, formerly with D. & B. Pump & Supply Co., Los Angeles, Calif., has been engaged by the W. B. Huber Co., Los Angeles, to increase its foundry production. Mr. Gilmour was with the Edward P. Allis Co., Milwaukee, in 1908 and in 1916 was superintendent of the American Foundry Co., Indianapolis.

W. C. McFarlane, president, Minneapolis Steel & Machinery Co., recently was elected resident of the Manufacturers Association of Minneapolis.

T. W. Spier has been placed in charge of the foundry of the D. & B. Pump & Supply Co., Los Angeles, Calif.

Dominic Meaglia, American Foundry Co., Los Angeles, Calif., has returned from a trip to Italy, via England and France.

Arthur Wathey has been elected vice president of the Bowler Foundry Co., Cleveland, to fill the vacancy caused by the death of Walter S. Bowler. Mr. Wathey has been sales representative of the foundry for the past 15 years.

Arthur B. Hykes has resigned as assistant general sales manager of the Central Iron & Steel Co., Harrisburg, Pa.

W. E. Lewis, Anniston, N. Y., has been appointed manager of the Addyston, O., works of the U. S. Cast Iron Pipe & Foundry Co., Burlington, N. J., succeeding Charles Seitz who recently was killed in an automobile accident.

Sales Staff Meets

H. S. Simpson, president of the National Engineering Co., Chicago, was host to members of the office and sales staff of that company at a dinner held at the Union League club, Chicago, Wednesday, Dec. 12. The dinner was followed by a theater party. In addition to the officers of the company and employes, C. E. Hoyt, executive secretary, American Foundrymen's association, and Mrs. Hoyt were special guests at the banquet which was served.

Merge Eastern Foundries

Barlow Foundry Inc. and Louis Sacks Inc. of Newark, N. J., have been consolidated under the name Sacks-Barlow Foundries Inc. The new company also controls the Newark Malleable Iron Co. and has purchased the plant and business of the Morrison-Flockhart Foundry Co., also of Newark. This consolidation makes Sacks-Barlow Foundries Inc. one of the largest producers of gray iron and malleable castings in the East.

David L. Sacks will be president of the new corporation, Arthur E. Barlow, treasurer; John L. Carter, vice president and general manager, and David McIntosh, vice president and works manager.

David L. Sacks, president of the new company, formerly was president of Louis Sacks Inc. which was founded by his father, Louis Sacks, in 1882. The plant of this company is one of the largest in Newark, including both gray iron and malleable shops. Mr. Sacks is one of Newark's most prominent foundrymen and has been active in the Newark Foundrymen's association and the Gray Iron institute.

Arthur E. Barlow, treasurer, has been well known to the trade for over thirty years. Barlow Foundry Inc. is one of the oldest foundries in the country, having been founded in 1826

by Seth Boyden, who discovered the process for manufacturing malleable iron and produced the first malleable castings ever made in this country. John Barlow began his connection with the company in 1858 and was succeeded in 1898 by his son, Arthur E. Barlow, who enlarged the business and built the present plant in 1914. Mr. Barlow for many years was president of the Newark Foundrymen's association and was one of the original founders of the American Foundrymen's association. He has always taken an active interest in the training of apprentices for the foundry trade and is now chairman of the committee on industrial training of the New Jersey Manufacturers' association and the Newark chamber of commerce.

John L. Carter, vice president and general manager, has been general manager of Barlow Foundry Inc. for the past twelve years. He is a mechanical engineer, a graduate of Stevens Institute of Technology and Princeton university, president of the Newark Foundrymen's association and a member of the executive committee of the Gray Iron institute.

The board of directors will also include Jos. M. Perrine, Walter Kiddie and Samuel F. Dixon. Mr. Perrine is president of Perrine and Buckelew, lumber dealers, president of the Jamesburg National bank and is well known in banking and business circles. Mr. Kiddie is an engineer of distinction, president of Walter Kiddie & Co., engineers, constructors and manufacturers, chairman of the board of trustees of Stevens Institute of Technology and a former New Jersey state highway commissioner. Mr. Dixon is president of Wm. Dixon Inc., manufacturers of brushes and jeweler's supplies, president of the American Brush Manufacturers association, director of the recently consolidated New Jersey National Bank & Trust Co. and prominently connected with many Newark business enterprises.

The sales organization will include Wm. E. Leary Jr., Barlow Foundry Inc.; L. E. Adams, Louis Sacks Inc.; and James Morrison, Morrison-Flockhart Foundry Co.

The new corporation will manufacture gray iron castings of all descriptions from very light work to 10 tons weight. The increased plant and organization facilities will enable them to segregate various classes of work in separate departments, each served by a separate cupola melting only the proper grade of iron. The new company also will engage extensively in the manufacture of high test cast iron.

Sacks-Barlow Foundries Inc., also will produce malleable castings.

Faked Foundry Facts

Pinch Dogs

Foundry Association Directory

American Foundrymen's Association

President, S. T. JOHNSTON, S. Obermayer Co., Chicago; secretary-treasurer, C. E. HOYT, 222 West Adams street, Chicago; technical secretary, R. E. KENNEDY, 222 West Adams street, Chicago.

Associated Brass Founders of New England

President, J. A. DUNCAN, Wm. Duncan & Sons Co., 166 Liverpool street, East Boston, Mass; secretary, LEROY ROBINSON, 141 Milk street, Boston. Meeting the fourth Wednesday of each month at the Engineers' club, Boston.

The Buffalo Foundrymen

President, J. MCARTHUR, Washington Iron Works; secretary, W. J. WARK, E. J. Woodison Co., 140 Chandler street. Meetings each month at club rooms, 140 Chandler street.

Central Illinois Foundrymen's Club

President, H. M. HIRE, Hire Foundry Co., Peoria, Ill.; secretary, FRANKLIN WHITEHEAD, The Meadows Mfg. Co., Bloomington, Ill.

Chicago Foundrymen's Club

President, DAVID G. ANDERSON, Western Electric Co.; secretary, ALBERT N. WALLIN, S. Obermayer Co., 2563 W. Eighteenth street. Meetings second Saturday in each month at the City club, 315 Plymouth court.

Connecticut Foundrymen's Association

President, FRED W. STICKLE, 25 Woodrow street, West Hartford, Conn.; secretary, C. S. NEUMANN, Union Mfg. Co., New Britain, Conn. Meetings are on second Friday of each month in various parts of the state.

Detroit Foundrymen's Association

President, J. J. BOLAND, Griffin Wheel Co., Detroit; secretary, ROBERT HOPE, 5502 Ivanhoe, Detroit. Meetings third Thursday in each month at appointed place.

East Bay Foundrymen's Association

Secretary O. R. MOLLER, Electric Steel Foundry Co. Inc., 1328 Second street, Berkeley, Calif.

Gray Iron Institute

President, WALTER L. SEELBACH, Forest City-Walworth Run Foundries Co., Cleveland; Secretary, ARTHUR J. TUSCANY, Terminal Tower building, Cleveland.

Malleable Iron Research Institute

President, F. L. SIVYER, Rockford-Northwestern Malleable Corp., Rockford, Ill.; secretary, ROBERT E. BELT, Union Trust building, Cleveland.

Metropolitan Brass Founders' Association

President WILLIAM EMBER, Jefferson Brass Foundry, 62 Delevan street, Brooklyn N. Y.; secretary, WILLIAM E. PAULSON, Thomas Paulson & Son Inc., 97 Second avenue, Brooklyn, N. Y. Meeting second Wednesday in each month at the Building Trades club, 2 Park avenue, New York.

Newark Foundrymen's Association

President, J. L. CARTER, Sachs-Barlow Foundries, Inc., Newark; secretary W. H. MANTZ, Atlas Foundry Co., Irvington, N. J. Meeting called by president.

New England Foundrymen's Association

President, CHARL F. MILLER, Universal Winding Co., Providence, R. I.; secretary, FRED F. STOCKWELL, 205 Broadway, Cambridgeport, Mass. Meetings second Wednesday of each month at the Exchange club, Boston. Outings usually are held in the summer months.

Ohio Foundries Association Inc.

President, C. C. SMITH, Toledo Steel Casting Co., Bancroft and Smead avenue, Toledo, O.; secretary-manager, E. F. SCOTT, 418 Penton building, Cleveland.

Philadelphia Foundrymen's Association

President, WALTER WOOD, R. D. Wood & Co., Philadelphia; secretary HOWARD EVANS, Union League club, Philadelphia. Meetings the second Wednesday of each month at the Manufacturers' club.

Southern Metal Trades Association

President, GEORGE B. COCKER, Gastonia, N. C.; secretary, W. E. DUNN JR., Healy building, Atlanta, Ga.

Pittsburgh Foundrymen's Association

President, W. P. BRADLEY, Wheeling Mold & Foundry Co.; secretary-treasurer WILLIAM J. BRANT, Wm. J. Brant, Bessemer building, Pittsburgh. Meeting on the third Monday of the month, except in July and August, at Fort Pitt hotel.

Quad-City Foundrymen's Association

President, A. D. MATHESON, French & Hecht, Davenport, Iowa; secretary-treasurer, HUGO WOLF, Frank Foundries Corp., Davenport, Iowa. Meetings the third Monday of each month, the meeting place being rotated between Moline, Rock Island and Davenport.

Tri-City Technical Council

Chairman F. V. SKELLEY, Tri-City Railway Co., Rock Island, Ill.; treasurer, MAX SKLOVSKY, Deere & Co., Moline, Ill. Combined meetings held only one or two times a year on call.

Tri-State Foundrymen's Association

President, A. G. WESSLING, Wessling Bros. Foundry Co., 1607 McLean avenue; secretary, GEORGE W. PIEHL, Wessling Bros. Foundry Co., 1607 McLean avenue. Meetings the second Thursday of each month at the Cincinnati club, Eighth and Race streets.

Twin City Foundrymen's Association

President, WILLIAM E. LOBERG, American Hoist & Derrick Co., St. Paul; secretary-treasurer, C. E. LANGDON, 3849 Lyndale avenue, south, Minneapolis. Meeting third Wednesday of each month at Athletic club.

Washington Foundrymen's Club

President, RONALD KUCHER, Olympic Foundry Co., Argo Station, Seattle; secretary, EDWARD C. GUSTIN, The Prescott Co., 1 West Lander street, Seattle. Meetings second and fourth Tuesdays of each month at the Elks Temple, Fourth avenue and Spring street.

Obituary

Strickland Landis Kneass, 67, vice president, William Sellers & Co., Philadelphia, died Nov. 25, following a brief illness. He was the inventor of a locomotive boiler injector device and other appliances. Mr. Kneass was born in Philadelphia and while he was graduated in 1880 from the Rensselaer Polytechnic institute as a civil engineer, he devoted most of his time to mechanical engineering.

George M. Stedman, president and general manager of the Stedman Foundry & Machine Works, Aurora, Ind., died in Milwaukee, Nov. 27 after a two months' illness with heart disease. He was 62 years of age. Mr. Stedman retired from active business four years ago.

William H. Wasweyler, president, Milwaukee Brass Mfg. Co., Milwaukee, died of heart disease on Dec. 1. Mr. Wasweyler was born in Milwaukee in 1864 and became president of his company in 1892.

Garland G. King, identified with the Alliance Machine Co., Alliance, O., since its organization, later as purchasing agent, died at Dalton, Ga., recently while on his way to Florida for the winter.

William M. Wilson, Downer's Grove, Ill., died Nov. 23 after a short illness. Mr. Wilson had been active in the foundry supply business for the last 30 or 40 years. For the last year and a half, he had been in charge of the bentonite sales for the Acme Oil Corp., 189 North Clark street, Chicago.

Harry W. Bury, foundry superintendent, Erie Foundry Co., Erie, Pa., died Nov. 23, after a week's illness. Mr. Bury had been an employe of the Erie Foundry Co. for the past 15 years and previously had been employed by the Erie Engine Works and other foundries in Erie.

Charles Seitz, resident manager, U. S. Cast Iron Pipe & Foundry Co., Addyston, O., was killed in an automobile accident Dec. 1. He was 53 years of age and had been in the company's employ for more than 20 years. He first worked for the company at the Addyston plant and later was appointed superintendent of the Scottdale, Pa., plant. About a year ago he returned to the Addyston plant as resident manager.

Robert Campbell, aged 79, who built many soil pipe plants both in this country and abroad, died recently at Gadsden, Ala., after an illness of two years. Mr. Campbell was born in Scotland and came to this country when 15 years of age. He became apprenticed to the Noble Bros. Co., which made cannon and munitions for the Confederacy. After seven years apprenticeship he became a molder. In the early nineties he became interested in the soil pipe business and designed and built many of the plants in Gadsden, Ala., Bessemer, Ala., Talladega, Ala., Chattanooga, Tenn., and Rome, Ga. After the recent war, he returned to Scotland and was commissioned by the British board of trade to build a pipe plant for an association of 34 plant owners in Great Britain. When the plant was completed and in operation, he built another in India. After five years, he returned to Gadsden and retired.

ROBERT CAMPBELL

Bertrand G. Mackey died in Seneca Falls, N. Y., Nov. 26. Prior to 1926 he was purchasing agent for Gould Pumps, Inc., Seneca Falls, N. Y., but retired at that time because of ill health. Mr. Mackey was born at Locke, N. Y., in 1875. He became identified with the Gould company in 1906 as assistant purchasing agent and in 1908 was promoted to purchasing agent.

Willard R. Eaton, formerly president of the Richardson-Boynton Iron Works, Jersey City, N. J., died Nov. 17 at his home in Albuquerque, N. Mex., where he had been living for the past year.

William C. Greene, 76, since 1916 vice president and works manager of the Builders' Iron Foundry, Providence, R. I., died there recently.

Climax Molybdenum Co., 61 Broadway, New York, has moved its Detroit office from 611 Donovan building to 2807 Book Tower building.

Melt Iron in the Cupola

(*Concluded from Page* 32)

Under these conditions the molten metal flowing into the receiver in a thin stream is subjected to the intensity of the oil flames. The same oil flames continually playing over the surface of the molten metal in the bath, maintain the superheat imparted to the metal as it enters the receiver. This oil fired receiver also can be constructed as a tilting type, thus eliminating the necessity for making up the tap hole. Provision also can be made for pouring excess or cold metal back into the receiver. In combination with a slag removing device, the receiver can be used for conducting desulphurizing processes and additions of ferroalloys satisfactorily can be made to the metal.

Has New Members

The Gray Iron institute, Terminal Tower building, Cleveland, has enrolled 5 new members in its organization. The following firms recently were accepted to membership: White Foundry Co. Inc., Jersey City, N. J.; Erie Grey Iron Co., Erie, Pa.; Cascade Foundry Co., Erie, Pa.; Aurora Foundry Co., Aurora, Ill.; Canton Pattern & Mfg. Co., Canton, O.

Brass Founders Meet

A joint meeting of the Associated Brass Founders of New England and the New England Foundrymen's association was held Dec. 19 at the Engineers club, 2 Commonwealth avenue, Boston. The meeting was in the form of a Christmas party and farewell dinner in honor of L. P. Robinson who is leaving that section of the country to accept a position in the west. A. B. Root, a past president of the American Foundrymen's association and also of the New England Foundrymen's association, was the speaker of the evening. He gave a talk on the coming Chicago convention and on the program and activities connected with the international convention which will be held in Europe in June, 1929.

See Instructive Movie

The regular December meeting of the Philadelphia Foundrymen's association, Inc., was held at the Manufacturers' club, Dec. 12. Vernon Wells, representative of the Carborundum Co., Niagara Falls, N. Y., presented a moving picture entitled "Jewels of Industry," which showed the making of grinding wheels and other abrasive products.

What the Foundries Are Doing

Reflecting the Activities of the Gray Iron, Malleable, Steel and Brass Shops

Western Stove Co., Culver City, Calif., is constructing additional warehouse space.

Century Electric Co., 1806 Pine street, St. Louis, is building a foundry addition.

Kay Steel Wheel Co., Alhambra, Calif., is erecting a steel frame building 80 x 200 feet, with a crane runway, loading platforms, etc.

Anderson Engine & Foundry Co., Anderson, Ind., reports business good and its plant operating at capacity.

General Foundry & Machine Co., Flint, Mich., is expanding its plant at Marshall, Mich., and will install additional equipment.

Oakley Pattern & Foundry Co., Cincinnati, has awarded the general contract to Erwin Hoinke for an addition 43 x 80 feet.

Peerless Foundry Co., 1843 Ludlow street, Indianapolis, has filed plans for a one-story addition to cost about $25,000 with equipment.

Granite City Iron Works, St. Cloud, Minn., has awarded contract to L. A. Borget, for a 1-story foundry addition, 20 x 50 feet.

National Foundry & Machine Co., Worcester, Mass., is erecting a building, 40 x 80 feet, to take care of increasing business.

Construction of the new plant of the Okaw Stove & Enameling Co., New Athens, Ill., is progressing. (Noted Nov. 10.)

Venus Mfg. Co., Los Angeles, Calif., has moved into new and larger quarters at 140 West Seventeenth street.

Copper Clad Malleable Range Co., 821 North Second street, St. Louis, contemplates additions to foundry.

Harrison Radiator Co., Lockport, N. Y., has awarded the concrete reinforcing bar contract for an addition to Kalman Steel Co.

Bay City Electric Steel Castings Co., Bay City, Mich., has awarded the structural steel contract for a foundry to Flint Structural Steel Co.

Superior Die Casting Co., 875 East Seventieth street, Cleveland, has doubled the space in its new plant. Additional facilities will be completed soon.

Aetna Standard Engineering Co., Warren, O., M. I. Arms, president, is contemplating the erection of a foundry to cost $100,000. (Noted Nov. 15.)

Doehler Die Casting Co., Smead and Prospect streets, Toledo, O., will increase its capacity with a new unit of 10,000 square feet of floor space.

Sellersville Foundry & Machine Co., Sellersville, Pa., is negotiating for a new site. Locations in both Souderton, Pa., and Telford, Pa., are under consideration.

Machias Foundry & Machine Co., Machias, N. Y., incorporated recently, advises that it plans the construction of a plant and the purchase of machinery.

The Southern Stove Works, Advance Stove Works, Crescent Stove Works and Indiana Stove Works, all of Evansville, Ind., are reported to be considering a merger.

Lappen Foundry Co., Crookston, Minn., is rebuilding its entire plant and production will be somewhat curtailed for about a year while rearrangement is going on.

Marshall Furnace Co., Marshall, Mich., contemplates the erection of a plant next spring but due to the press of business it may start its construction at an earlier date.

Smith Process Inc., Boston, has been incorporated with $50,000 capital by Edward N. Robinson, Danvers, Mass., to engage in the foundry business, manufacture castings etc.

Columbia Steel Co. is contemplating the erection of a large new steel foundry at Portland, Oreg., to replace the small one it now has in operation there.

Weihl Bros., Brooklyn, N. Y., care of Tobias Goldstein, 26 Court street, architect, has asked bids on general contract for a new foundry to cost about $27,000 with equipment.

Valley Iron Works Co., St. Paul, has let general contract to Lauer Bros., 431 Gilfillan block, for a 1-story foundry addition, 40 x 60 feet, at Livingston avenue and River street.

Campbell, Wyant & Cannon Foundry Co., Muskegon Heights, Mich., plans the construction of a new service and storage garage, to replace the one recently damaged by fire.

Stockholders of the West Park Foundry Co., Cleveland, have decided to discontinue the business of that company. A meeting was held Dec. 14 to decide upon plans of liquidation.

Central Iron & Steel Co., Harrisburg, Pa., has completed its brass foundry. The new shop will produce castings for the use of the company exclusively.

Board of education, Cleveland, will take new bids on the construction of a 1 and 2-story foundry addition. F. G. Hogan, East Fourth and Rockwell streets, is director.

The foundry department of the Lisenby Mfg. Co., Fresno, Calif., has been sold to M. G. Wilson and G. N. Nutwell, who are making a specialty of memorial tablets and other ornamental bronze work.

American Foundry Co., Los Angeles, Calif., has purchased an additional 13,000 square feet adjoining its property on Date street. The ground will be used for additional molding floor space.

Electric Steel & Mfg. Co., 3334 East Slauson avenue, Los Angeles, Calif., recently has completed an addition 60 x 130 feet, affording added space for various departments, especially that for heat treating.

Directors of the Cincinnati Car Co., Cincinnati, have approved the terms of merger with the Versare Corp., Albany, N. Y., under which the manufacturing operations will be centered in Cincinnati.

International Derrick & Equipment Co., Delaware, O., operating a foundry here on Toledo street, is making ready to start an expansion program. An addition, 70 x 150 feet, will be built.

Anderson Stove & Foundry Co., Anderson, Ind., has occupied an addition 60 x 100 feet, which will allow expansion of its production. Another addition is under way for use as a stock room.

Frank Foundries Corp., 125 Twenty-first street, Moline, Ill., has let contract to Axel Carlson, 506 Fifteenth street, for a 1-story foundry, 100 x 160 feet, and a 1-story shipping building, 70 x 100 feet. (Noted Nov. 22.)

Michael Hayman & Co., 856 East Ferry street, Buffalo, has awarded general contract to H. F. Stimm, Inc., Ellicott Square, for a 1-story foundry addition to cost $25,000 with equipment.

Greenlee Bros., Inc., Twelfth street, Rockford, Ill., has awarded general contract to John M. Anderson, 1235 Jackson street, for a 1-story foundry addition, 120 x 350 feet, to cost over $75,000 with equipment.

Kingsport Foundry & Machine Works Co., Sullivan and Center streets, Kingsport, Tenn., plans the construction of an addition, 75 x 100 feet, to provide more space for adequate operation of the plant.

City Brass Works Co., 1742-44 Carroll avenue, Chicago, specializing in German silver, brass and bronze hardware, fittings, etc., is contemplating the erection of a new foundry in the spring.

Louisville Frog, Switch & Signal Co., Louisville, Ky., has been organized to take over and consolidate Louisville Frog & Switch Co., and Southern Signal Co., both of Louisville. The latter plant specializes in the production of castings as well as signal equipment.

N. S. Sherman Machine & Iron Works, 18 East Main street, Oklahoma City, Okla., has awarded general contract to H. W. Underhill Construction Co., Braniff building, for a one-story addition, 50 x 140 feet, to cost about $35,000.

Cunningham & Son, Ltd., St. Paul street, St. Catharines, Ont., manufacturer of castings, will make alterations and additions to its plant and has awarded general contract to P. Teatero & Son, 112 Louisa street, St. Catharines, Ont.

American Steel Foundries, 410 North Michigan avenue, Chicago, has awarded general contract to the Sumner-Sollitt Co., 307 North Michigan avenue, for a one-story addition at East Chicago, Ind., plant, 75 x 100 feet, to cost about $50,000 with equipment.

Kerr Metal Products Ltd., Hamilton, Ont., has been incorporated with $40,000 capital by Thomas H. Simpson, Frederick R. Murgatroyd, and Eva Ambrose, all of Hamilton, Ont., to carry on the business as brass and iron founder, engineer, and manufacturer of metals.

Dominion Radiator & Boiler Co., 1322 Dufferin street, Toronto, Ont., has awarded contracts for construction of cupola pits as follows: Steel, Dominion Bridge Co., Redford building; excavation and concrete work, Thomson Bros., 56 Grenville street.

The Dominion Bridge Co., Montreal, Que., has just acquired control of the works of the Calgary Iron Works, Calgary, for about $500,000, partly in cash and partly in stock. An addition estimated to cost $300,000 is to be made to the Calgary works by spring.

The tractor department of the Minneapolis Steel & Machinery Co., Minneapolis, is turning out three times last year's volume of business, it is announced, and the foundry department two and one-half times that of a year ago.

B. & B. Foundry Co., 1540 West Thirty-fifth street, Chicago, makers of brass, bronze and aluminum castings, has purchased several hundred dollars worth of foundry equipment and has rearranged its foundry to take care of increased production.

Economy Pattern Works, Chicago, has moved from 1925 Elston avenue, to new quarters at 2914-16 Elston avenue. This firm has sold the interest in its foundry and now is manufacturing wood and metal patterns exclusively. C. P. Seiffert is general manager.

Agate Foundries, Inc., 1721-25 Maypole avenue, Chicago, has been reorganized. D. H. Brownlee has sold his interest in the company to the new officers, P. Wachtel, president; J. Meshan, treasurer; F. Wachtel, secretary.

Michigan Smelting & Refining Co., Detroit, a subsidiary of Bohn Aluminum & Brass Corp., 2512 East Grand boulevard, is inquiring for machine equipment for finishing small castings for proposed 1-story brass work plant, 60 x 200 feet.

American Radiator Co., New York, officials confirm reports that negotiations are under way for a merger with Standard Sanitary Mfg. Co. Pittsburgh, manufacturers of plumbing supplies. The potential melting capacity of the con-

solidation will be from 300,000 to 350,000 tons of pig iron.

Unique Lamp & Casting Co., 1948 North Kedvale avenue, Chicago, is specializing in fixture parts of exclusive design. This company also makes many white metal castings and is specializing in an alloy which is claimed to have several advantageous properties.

Robert Mitchell Co.,Montreal, Que., is preparing to increase its output. Plans have been made for a foundry, where operations in iron, brass and bronze will be concentrated, including a laboratory and research offices. The company has bought a large site close to the railway.

Imperial Iron Corp. Ltd., Toronto, Ont., has been incorporated to carry on the foundry business and manufacturing of furnaces, stoves, ranges and boilers with $500,000 capital and 25,000 shares no par value stock by Arthur W. Holmsted, Leonard V. Sutton and Eugene E. Hawke, all of Toronto.

Alamo Iron Works, Montana and LaFayette streets, San Antonio, Tex., plans the construction of a new pipe shop. This company recently celebrated its fiftieth anniversary, having been founded in 1878. Branch plants are now operating at Brownsville, Houston and Corpus Christi, Tex. E. A. Holmgreen is president, J. H. Holmgreen, vice president and Melrose Holmgreen, secretary-treasurer.

Meta-Mold Aluminum Co., Milwaukee, has moved from 129 East Michigan avenue to its new plant at Fifty-seventh avenue and Burnham street. The new plant will increase the company's facilities. This firm specializes in aluminum alloy castings in permanent, semipermanent, and sand molds.

American Cast Iron Pipe Co., Birmingham, Ala.. has plans under way for a 1-story foundry addition. It is reported that the addition will cost over $45,000 with equipment. This company also has let the contract for the steel for its addition to the Southern Steel Works, 908 Luicen avenue, Birmingham, Ala.

Georgetown Foundry & Machinery Co. Ltd., Georgetown, Ont., has been incorporated with 800 shares of no par value stock by Richard H. Sankey, Lorne C. Lee and William G. Tucker, all of Toronto, Ont., to carry on business as ironmaker, steelmaker, steel convertor, etc.

Roos Foundries, Inc., 1749 Ballou street, Chicago, has been reorganized. The officers of the firm are J. P. Hansen, president, treasurer and general manager; P. C. Peterson, vice president; and G. R. Bloom, secretary. The company will manufacture gray iron castings.

Wilson Foundry & Machine Co., Pontiac, Mich., was shut down the week of Dec. 10 to permit the installation of a new conveyor system. The conveyor is of the continuous chain type and is expected to carry about 2500 castings per day from the foundry to the cleaning room of the machine shop. The new installation cost about $200,000.

Reliance Bronze & Aluminum Foundry, Philadelphia, recently organized by Alfred Haeberle, 268 West Fishers avenue, Philadelphia, and associates plans early operation of a local plant to manufacture brass, bronze, aluminum and other metal castings. Arthur W. Schuller, also is interested in the company.

Weidenmiller Bros., Chicago, has completed a foundry building of three stories, equipped with melting furnaces, sand blast and 10-ton hoist. The company manufactures brass, bronze, aluminum, nickel silver and special alloy castings. Edward A. Weidenmiller is president and Emil O. Weidenmiller is secretary and treasurer.

W. P. Laytham & Sons Co., Paterson, N. J., has completed installation of continuous molding equipment, placed by the C. O. Bartlett & Snow Co., Cleveland. The equipment is used for the production of relatively small ornamental iron castings and is designed to increase capacity without material enlargement of floor space.

Mal-Gra Castings Co., Cambridge City, Ind., has been incorporated in Ohio by George J. O'Brien, in charge of the Middletown, O., plant. This plant has been in operation since last year when the plant of the Midwest Casting Co. was purchased. A movement toward the company's development will be engineered through the Middletown office.

Bessemer Engine Co., Grove City, Pa., has undergone a change in control. E. J. Fithian and associates have bought stock from heirs of John Carruthers. Members of the Carruthers family already had retired from offices in the company. The concern was founded about 30 years ago and has been an important manufacturer of gas and oil engines.

The plant of the Ideal Bronze Co., 1265 East Fifty-fifth street, Cleveland, recently merged with the Wellman Bronze Co., 6017 Superior avenue N. E., Cleveland, is being dismantled and most of the equipment is being moved to the site of the Wellman plant. Parts of the equipment, however, will be sold, according to H. G. Wellman, vice president and secretary of the company which bears his name. The Ideal plant will be completely dismantled by Jan. 1.

Scott-Witter Steel Corp., Hartford, Conn., has been organized to manufacture carbon and alloy steel castings at the former plant of the Connecticut Electric Steel Co., Flatbush avenue, Hartford, Conn. The officers of the new company are: Fredrick L. Hewitt, formerly vice president, Hanson-Van Winkle-Manning Co., chairman of the board of directors; John D. Scott, president; Claude L. Witter, president, Provident Engineering Corp., Philadelphia, vice president and Albert W. Gray, secretary and treasurer.

Allis-Chalmers Mfg. Co., Milwaukee, has placed a contract with W. W. Oeflein, Inc., 110 East Wisconsin avenue, Milwaukee, for a brick and steel foundry building, 130 x 144 feet, and a heat treating shop, 50 x 120 feet, as extensions to the tractor plant at the main works at West Allis. Estimates also have been closed on a manufacturing building, 200 x 600 feet, for this division. Extensions also will be made to the tractor plant at Springfield, Ill. Purchase of equipment has been under way for some time.

Warren Pipe & Foundry Co., Phillipsburg, N. J., will build a large cast iron pipe manufacturing plant in Everett, Mass., according to a recent announcement of the Associated Industries of Massachusetts. The exact location of the plant temporarily is withheld because of the necessity of closing certain streets which have been platted but never built. New England's only merchant blast furnace, that of the Mystic Iron Works, is located at Everett, Mass. This was the determining factor in the location of the proposed pipe manufacturing plant.

Stockham Pipe & Fitting Co., Birmingham, Ala., has started the erection of a steel storage building under the direction of H. K. Ferguson Co., Cleveland, which is to be completed by Christmas. A new laboratory will also be constructed. The sub-contracts for this work have been let as follows: Structural steel, Southern Structural Steel Works, Birmingham, Ala.; wood block floor, Jennison Wright Co., Toledo, O.; steel sash, Truscon Steel Co., Youngstown, O.; sash erection, United Erecting Co., Cleveland; metal roofing, siding and ventilators, H. H. Robertson Co., Pittsburgh; plumbing, Tully Heating & Plumbing Co., Birmingham, Ala.; electrical work, Bagby Elevator & Electric Co., Inc., Birmingham, Ala.; overhead doors, Overhead Door Co. of Alabama; elevators, furnished and installed by Otis Elevator Co., Eleventh avenue and Twenty-sixth street, New York.

New Trade Publications

STEEL CASTINGS—Nugent Steel Casting Co., Chicago, in a current bulletin features advantages of its product where space is limited, and strength is paramount.

CONCRETE ADMIXTURE—Celite Products Co., Los Angeles, is mailing a leaflet covering use of its product in concrete to bring about cohesive workability. It is illustrated.

NONFERROUS SPECIFICATIONS—Niagara Falls Smelting & Refining Corp., Buffalo, has prepared a leaflet containing United States navy specifications for nonferrous alloys. They are in tabular form, with notes on purposes to which they are best applied.

ELECTRICAL APPLIANCES—General Electric Co., Schenectady, N. Y., has issued recent bulletins on the following equipment: Magnetic controllers, automatic throw-over panels, direct current motors, single stage centrifugal air compressors, adjustable speed direct current motors, arc suppressor plates and enclosed starting rheostats.

AIR COMPRESSORS—Chicago Pneumatic Tool Co., 6 East Forty-fourth street, New York, is issuing a folder on its vertical simplex air compressors. The details of construction and the materials used are discussed. The folder is illustrated with views of the various types of machinery this company manufactures. Tables accompany the illustrations which give a complete description of the machines.

BLOWERS—Connersville Blower Co., Connersville, Ind., has issued a bulletin on two types of its rotary positive blowers for foundry cupola, furnace installations, pneumatic conveying, cooling sheet packs and other service requiring large capacities at low and medium pressures or suctions. Drawings and halftones illustrate construction and operation. Tables indicate capacities and give data.

OIL ENGINES—Chicago Pneumatic Tool Co., 6 East Forty-fourth street, New York, is publishing a bulletin describing its semidiesel oil engines. The details of construction are illustrated and discussed. A recommendation of the fuels to be used is given. The feature of the booklet is a sectional view showing the parts of the semidiesel oil engines made by this company.

MOTORS—Reliance Electric & Engineering Co., Ivanhoe road, Cleveland, has published a folder on its fully-enclosed, fan-cooled motors. Descriptions of the types of motors which it manufactures are included with discussions of their advantages. The leaflet is well illustrated with photographs of the assembled and disassembled motor, drawings showing the methods of ventilation, and a view of a typical installation. Drawings accompanied with tables give the dimensions and ratings of the motors.

ABRASIVES—Norton Co., Worcester, Mass., is issuing a 27-page booklet on saw grinding and knife sharpening in southern saw mills. The booklet gives the conditions which govern the action of grinding wheels used for this purpose. It also gives a list of troubles and their remedies with a table of grinding wheel speeds. Recommendations of grinding wheels for saws and knives used for various purposes in saw mills and discussions of the recommendations also are included.